Engineering Applications of Electricity—Motor-drive Arrangements in the Textile and Other Industries—with the Regular Departments

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Electrical World

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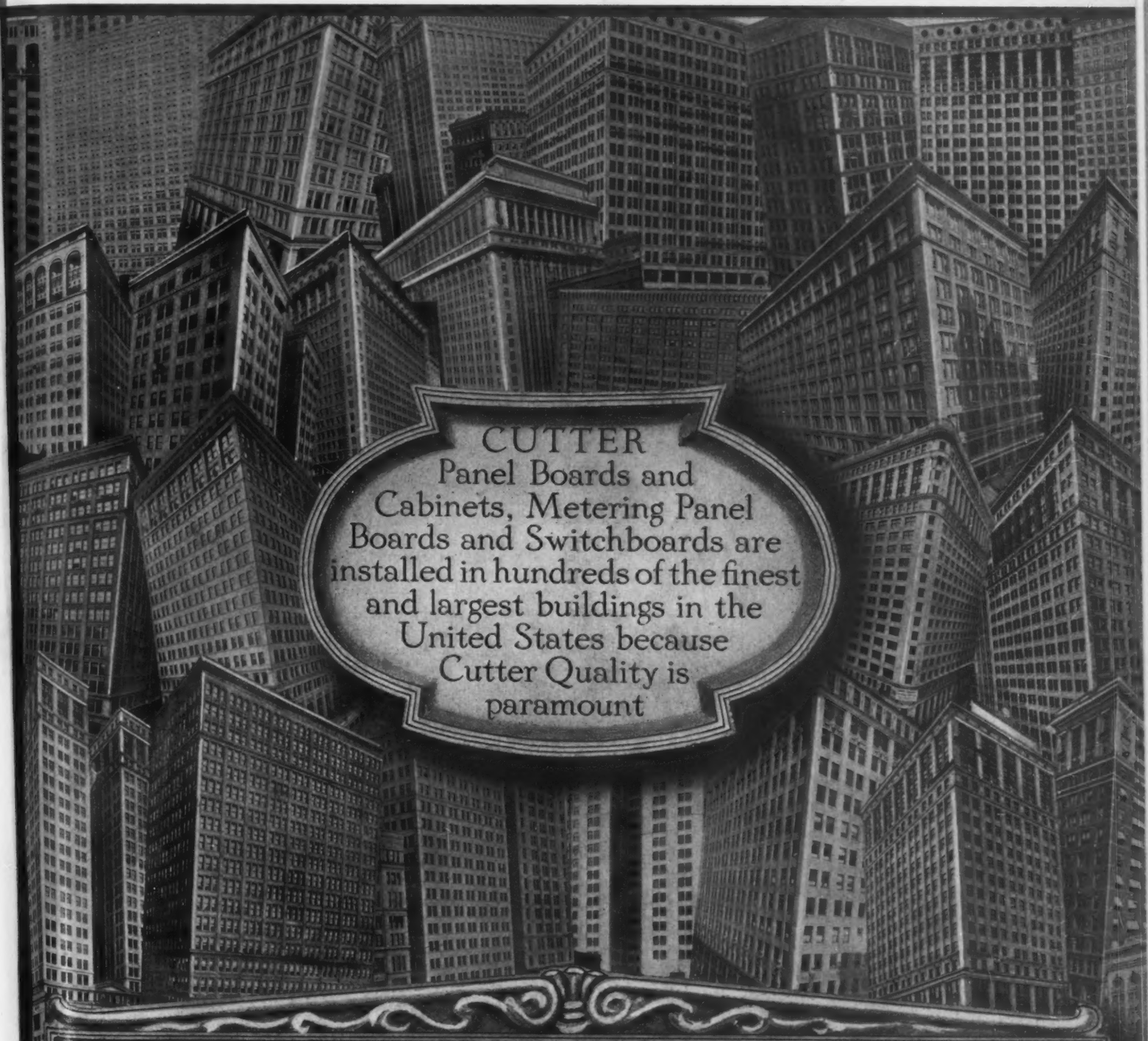

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For complete information regarding Model 310 Wattmeters write for Bulletin No. 2002. Other models in this group (illustrated in the order named) are Model 341 A.C. and D.C. Portable Voltmeter, described in Bulletin No. 2004; Model 329 Portable Polyphase Wattmeter, described in Bulletin No 2002; and Model 370 A.C. and D.C. Portable Ammeter, described in Bulletin No. 2003.

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Preparedness in Manufacturing

AT a juncture when they are planning to enter foreign fields on a larger scale electrical manufacturers are confronted by a great and expanding domestic demand. Just what effect this will have on the effort to broaden markets remains to be seen. Among the manufacturers who have not tried to develop overseas trade there has been a tendency in the past to argue that, with domestic business in good shape, foreign business was not essential to their prosperity. If safe markets at fair profits could be found at home, they maintained, what was the use of going abroad and deliberately adding unknown problems? No one will say that the war has not raised new considerations which are of paramount importance. At present this country is filling orders from quarters of the globe which are turning to our manufacturers for the first time. After the conclusion of the war we shall probably receive inquiries from Europe for enormous quantities of materials for reconstruction. And the Pan-American countries are turning to this nation more whole-heartedly than ever before. In the last year and a half United States investors have filled for Canada the place formerly occupied by England. All of these factors point to an international interest, opportunity and sympathy which will mean commerce provided our manufacturers are prepared.

A Significant Power Investigation

OWING to the continual growth of its load, the Boston Elevated Railway will shortly be obliged to extend its power-plant facilities. An investigation concluded not long since indicates the wisdom of adding a 35,000-kw. turbo-generator to the main alternating-current station of the company at South Boston. In some of its aspects this investigation is of unusual engineering interest, for the reason that the company's consulting experts took a very broad view of the power problem, looking at least five years ahead, taking the existing plants and substations in a group as related to the total anticipated load increase, and studying the economics of turbo-units with keen appreciation of the importance of the total of the small gains in efficiency spread through half a decade. To the operating engineer the most interesting phase of the investigation is the conclusion that by the installation of a 35,000-kw. turbo-unit, instead of a 20,000-kw. outfit, the gains in operating economy will pay the added cost of the former in the five-year period. The estimated output for five years is 1,180,000,000 kw.-hr. The approximate cost of this energy is $3,200,000 for the larger unit and $3,400,000 for the smaller, or a unit rate of 0.27 cent per kilowatt-hour for the 35,000-kw. machine and 0.28 cent for the 20,000-kw. set. Here a difference of one-hundredth of a cent per kilowatt-hour, multiplied into a five-year output, reaches the total of $200,000, which is said to be practically the difference in cost of the two units. What an argument for the use of large turbines this is! And if the use of a boiler pressure of perhaps double to three times the present practice should accompany the installation, who can doubt that the unit production cost may come close to 2 mills? Clearly, steam engineering is a long way from attaining the limits of economy, and even if the vast majority of installations can never hope to obtain the labor economies of these immense units, there is still much hope that by the use of boiler pressures of 400 lb. and upward remarkable gains may be realized even in moderate-sized plants.

Widening the Application of Electricity

ELECTRIC motor applications have very greatly increased within a comparatively few months. Both motor manufacturers and second-hand dealers in motors have been sold out and the industrial power load of central stations has been very greatly increased because of the pressing demand for power from the owners of industrial plants. War orders are largely responsible for this increase. Coming quickly, the demand for power has been met not by the slower process of enlarging the industrial steam plant's capacity but by putting in motors to take care of the extra load. In some cases, no doubt, this recognition of the flexibility of electric service has been forced on the owners of plants by the immediateness of their needs. That it will have real educational value in showing those hitherto immune to all the advantages of the motor drive how effective is the electric motor as a method of transmitting power there is no doubt. In this same period, too, has come increased activity in mining, and the application of electricity in the extractive industries has received a decided impetus. In the zinc regions about Joplin, Mo., one central station has reported increases in kilowatt-hour output of more than 375 per cent between December, 1914, and December, 1915, due largely to the demand for electricity in the zinc mines. The automobile industry and the steel industry have each called upon electricity for industrial heating, and very comprehensive statistics gathered by *The Iron Age* show an increase of 78 per cent in electric steel furnaces during 1915. There are now seventy-three such furnaces in the United

States. Many ingenious applications for electric heat are also being worked out. Absence of fumes and nicety of temperature control are two factors in this advance, of which examples are melting pots on type-setting machines and enameling and baking ovens in the automobile industry. Several articles in this issue call attention in detail to the widening application of electricity.

Legislation Regarding Lighting

A PAPER read by L. B. Marks before the Philadelphia Section of the Illuminating Engineering Society is an admirable résumé of the few things which have been done and of the many things which have not been done in legislation regarding lighting. The subject has many ramifications leading back to the same fundamental necessity of having such definite and wise enactments as may compel the proper lighting of buildings and other spaces in which the public is concerned. There are many sides to the topic—school lighting, factory lighting, the suitable provision of headlamps for locomotives and motor vehicles, the proper disposition of street lighting—and, besides all these things concerning artificial light, there remains the huge problem of the proper use and distribution of daylight.

Merely a cursory glance over Mr. Marks' paper indicates in what a hopeless muddle the whole matter now is. The intentions of our legislators are good in matters of this kind, but the statutes have been drawn up for the most part without any assistance from those possessing expert knowledge, and often in such vague terms as to lead to no definite results. A relatively small group of states, for example, has statutes bearing on schoolhouse affairs which prescribe at least something in the way of natural and artificial lighting. As regards the former matter, the amount of window space required varies from a seventh to a fourth of the floor space. It is generally prescribed that the lighting shall be from the left and rear of the direction in which the desks face, that the windows shall have rather high windowsills, and that the glass shall be carried quite near the ceiling. The intent of all this is of the best. The results would be fairly satisfactory were the requirements coupled with suitable legislation regarding the cutting off of proper light by neighboring buildings. As a rule, the statutory regulations go very little further than to state that schoolhouses must be lighted in a "proper" manner or so as "to minimize eye strain." In Ohio they have progressed far enough to have a law specifying the candle-power per square foot of floor area to be allowed for the electric lamps, a figure scarcely high enough, but permitting fairly satisfactory lighting if very skillfully arranged. On the latter point, however, nothing is said. The Illuminating Engineering Society is formulating a code for illuminating schoolhouses which will undoubtedly help matters very much if it can be put into effect.

The lighting of factories is in almost as chaotic a state as the lighting of schools. In about a dozen states the subject is taken under consideration, usually in an extremely vague manner. Legislators cannot be altogether blamed for uncertainty in this particular, since it is only within a very few years that the conditions of factory lighting have been worked out thoroughly enough to insure proper codification of the data. At the present time, however, ample evidence is at hand to permit the formulation of a suitable code. The Wisconsin commission is the only official body which has really gone into the matter carefully. It has issued instructions which, if intelligently carried out, would meet the situation reasonably well—even though the regulations leave a great deal to be desired in point of definiteness. The New York State Factory Investigating Commission, taking up the improvement of the vague existing regulations, obtained the co-operation of the Illuminating Engineering Society and prepared preliminary regulations which at least start the movement in the right direction. A code precise enough to meet required conditions reasonably well is the thing needed.

Mr. Marks calls attention also to the wide variation in state laws covering locomotive and automobile headlamps. A committee of the American Master Mechanics' Association investigated the subject carefully from the practical standpoint and reported in favor of a standard headlamp—according to its tests quite sufficient to meet all practical requirements—which would constitute a violation of law in many states. Respecting automobile headlamps, the regulations now in force point to diminishing their power so as to prevent the blinding glare which keeps other automobilists or pedestrians from avoiding imminent danger. Three or four states have already passed enactments covering this matter. Mr. Marks' summary clearly shows the opportunity for closer co-operative effort between legislative committees and engineering societies.

Electrolysis and Its Mitigation

THE new experimental results given in the paper by Dr. E. B. Rosa and Burton McCollum of the Bureau of Standards at Washington indicate, in general, the futility of such protective expedients against electrolysis as painting or covering the buried pipes in the streets. Insistence is therefore laid upon the known and tried methods of thoroughly bonding and cross-bonding the street rails, insulating pipe-joints, installing insulated return-track feeders, and limiting the potential difference in the track system. It is pointed out that restrictive regulation has been in force in Europe for a number of years and has there reduced the destructive electrolytic corrosion of steel pipes to a negligible quantity. If the gas, water and electric companies would co-operate in American cities for their mutual benefit, the difficulties here would likewise tend to disappear. Restrictive regulation by state commissions is urged, to be exerted not only on the electric railways but also on the owners of the street pipes. It is suggested that exploring potential wires be leased from the city telephone companies to enable the potential differences in the track system to be recorded

graphically from hour to hour and month to month in a central office, the cost to be distributed equitably between the electric railways, the water, gas and signaling companies and the city. The average system potential difference recorded in this way should not exceed a small specified number of volts. All new pipes should be laid down in the streets in such a manner as to minimize corrosion danger. The pamphlet holds out encouragement for the belief that by such procedure metallic corrosion in American city streets due to electrolytic corrosion may yet become insignificant without excessive cost to bring this about.

We think that the purport and conclusions of the pamphlet are sound and should receive careful consideration by all concerned. The question is one that affects many owners, not merely the electric railways but also the pipe lines, the signaling companies, the cities and the public. The burden of expense should neither be unnecessarily magnified nor thrown lightly upon the electric companies that are carrying the city traffic, to the exclusion of all other participants. A broad-minded co-operative policy is called for in applying reasonable regulations.

Installing "Light" Rather than "Lamps"

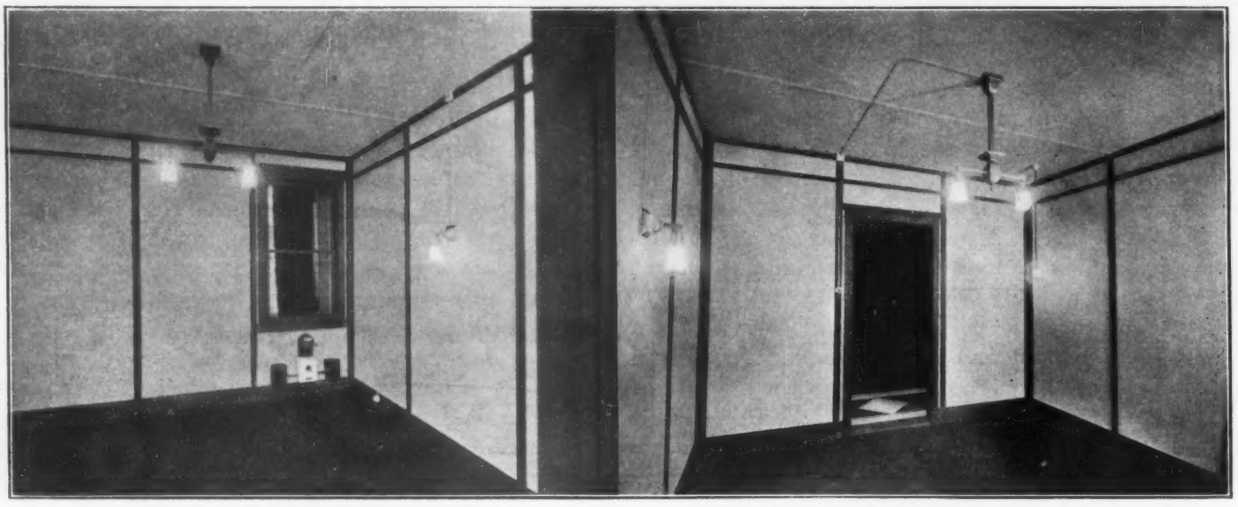
ALTHOUGH central stations, contractors and manufacturers of the progressive sort have been actively pushing the gas-filled tungsten lamp along some of the lines of least resistance and sometimes least profit, many have failed to grasp the larger opportunities open to them to maintain or increase lighting revenues and at the same time render a public service. The facility with which earlier electric lamps could be placed in all sorts of positions encouraged their use for decorative effects not before possible. However, the arc lamp and even the carbon filament of the old days were considerably brighter than any artificial illuminant to which we were before accustomed, and it gradually began to be evident that such promiscuous use of the new lamps without any means of diffusion or softening the light was in many cases bad both artistically and hygienically, and was sometimes a positive interference with clear vision. Gradually the resultant glare began to be considered garish and incompatible with real refinement in lighting, to say nothing of its hygienic aspect. On top of this came the improvement in the efficiency of the incandescent lamp, which rapidly increased its brightness or intrinsic brilliancy so as to make the need of shading or diffusion still more imperative for comfortable use. Scientific men devised methods of measurement and began to acquire much more definite knowledge of the bad effects of glare. All these factors have worked together to encourage and increase the use of indirect and semi-direct lighting and other methods by which the brightness of the original source of light is diffused or reduced before exposure to the eye. Each increase in the brightness of the incandescent lamp brought about by increase in efficiency has made it more necessary to diffuse that brightness and at the same time has made it more practicable to do so. The gain in lamp efficiency has more than offset the losses necessary with indirect and semi-direct lighting for interiors at all adapted to such systems. A given working-plane illumination can now be obtained in a typical modern office area, for example, for less energy than was required twenty years ago with a carbon-filament lamp installation very much worse from the standpoint of glare. Besides this, the rates for electrical energy have declined.

All this being the case, what is the proper course for the central-station company, the contractor and the manufacturer of lighting equipment? Obviously it is to push for the best in lighting rather than for the cheap, garish effect. Specifically, at the present time this means for interior work, in much occupied rooms, wherever feasible, the adoption of semi-direct lighting with very dense bowls, or indirect lighting, and for exteriors the use of concealed flood lights in place of the old outlining idea. Even the electric sign with exposed lamps is susceptible to diffusive treatment which makes it more comfortably legible and hence more effective. In such cases the adoption of these ideas usually means greater first cost and more electrical energy used for lighting than in the case of a cheap makeshift, but these are justified by the better results to consumer and public. It is, of course, true that there are still many consumers who insist upon glaring methods of illumination and will have nothing else, but the combined efforts of all who sell illumination, if exerted in the right direction, are powerful.

The Coming Issues

THE first issue of February — the public-relations number of the month—will inaugurate the series of "Talks in the Industry," previously announced, with an interview with Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, on the subject of public policy. The electrical fixation of atmospheric nitrogen as a factor in national defense will be the topic of a leading article in the department "Advance in Technical Theory and Practice." An abstract of R. S. Hale's address before the inspectors' convention at Chicago the past week, tracing the history of the concentric-wiring movement and defining its aims as a means of extending electric service to the small customer, is also planned for the Feb. 5 issue. In the station-operating number of Feb. 12 there will appear articles taking up the economics of the steam equipment of the medium-sized electric generating station and the problems involved in the excitation of synchronous machines. To the third or engineering issue of February John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, contributes an article on "Opportunities in Central-Station Work for the Young Electrical Engineer." Means of amplifying the oscillograph for lecture-room work, to be described in the same number, will be of particular educational interest. Tendencies and practices in handling large loads over cable-distributing systems will be the subject of an engineering article which will appear in this issue.

Exhibit Installation of Concentric Wiring at Chicago Convention of Electrical Inspectors



To afford a practical demonstration of house wiring with bare concentric conductor, during the convention of the Western Association of Electrical Inspectors, held at the Hotel Sherman in Chicago this week, the Commonwealth Edison Company had erected in the hotel a temporary room which was wired for ceiling and bracket lamps with the proposed conductor and fittings.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

States Win Power Rights

In a decision of wide application to water-power developments throughout the United States, the Supreme Court of the United States decided on Jan. 24 that States possess the power to enact laws authorizing condemnation of power sites and water rights by right of eminent domain. The decision was announced by Justice Holmes in upholding the constitutionality of the Alabama water-power condemnation statutes in a case touching the improvement of the Tallapoosa River. "The principal argument," said Justice Holmes, "is that the purpose of the condemnation is not a public one. To gather the streams from waste and to draw from them energy, labor without brains, and so to save mankind from toil, is to supply what, next to intellect, is the very foundation of all of our achievements and all our welfare. If that purpose is not public, we should be at a loss to say what is."

Plans for N. E. L. A. Geographic Sections Meeting

Chairman L. D. Gibbs of the N. E. L. A. geographic sections committee sent out a notice this week outlining various topics for consideration at the meeting of the committee at the Hotel Statler, Cleveland, Ohio, Feb. 3 and 4, 1916. The opening session will be held at 10 a. m. the first day, and the list of subjects for suggestive discussion includes numerous questions of policy. Among these are the matter of allowing the attendance of representatives of other public utilities at conventions when not objected to by Class A member companies, the centralization of publication work at the association headquarters, the possibilities in the way of establishing a standard schedule of conventions to avoid conflicts of dates and make attendance easier for the national officials, and the feasibility of securing more uniformity in geographic-section convention programs, leading to national discussion of topics in a "United States symposium." Greater cumulative value of papers and discussions, it is thought, may be secured in this way.

Minnesota Contractors Against Concentric Wiring

The midwinter meeting of the Minnesota Electrical Contractors' Association was held at the Builders' Exchange, St. Paul, Minn., on Jan. 24, with President T. W. Findley presiding. A paper by A. W. Lindgren of Duluth on "The Electrical Contractor in Business" induced considerable discussion on the position of the contractor with reference to the sale of fixtures and household appliances. It was the consensus of opinion that the contractor must establish modern, well arranged and equipped stores for this phase of his business if he expects to be the electrical dealer of the future, and that he must act before the hardware stores, department stores and drug stores succeed in securing a firm hold on the trade. It was pointed out that it is a mistake for the small contractor to think that he must engage in this appliance-sales business, since it cannot be a success when capital, proper display room and merchandising and advertising talent are limited. There was also discussion to the effect that there is no connection between the contracting and merchandising businesses, each being separate in itself. Others related experiences showing how the sales work brought them additional contracting work in providing necessary wiring and control for apparatus sold, indicating the close relation of the two phases of the industry. However, it was generally agreed that there must be a segregation of the sales room from the stock room and

shop and that expert merchandising ability should be employed in selling electrical devices.

A paper on "Facts About Concentric Wiring," by V. S. Beck of Minneapolis, in which he reviewed the usage and status of this form of wire up to the present time, brought out a general discussion, all in deprecation of the use of the wire. As a result the following resolution was passed by the association:

"The Minnesota Electrical Contractors' Association in convention assembled is of the opinion that the system of concentric wiring will prove detrimental from an engineering and contracting standpoint. Should this system be adopted it would greatly increase the life and fire hazard and would be a move in the wrong direction. Therefore, be it resolved, that the National Electrical Contractors' Association is hereby requested to use its good influence and best efforts to prevent its adoption and general use in this country."

A. W. Abbott of St. Paul gave a very interesting talk illustrated with charts on "Lighting an Art Gallery." G. G. Ryder of Minneapolis discussed the changes in the National Electrical Code, and this was followed by a suggestion that the contractors get together at frequent intervals for the purpose of going through the code and discussing it in detail with the view of a comprehensive understanding of the requirements.

The members in attendance were entertained by the St. Paul contractors at luncheon and dinner at Carling's and with a theater party in the evening.

Inspectors Voice Objections to Concentric Wiring

Western Association of Electrical Inspectors at Chicago Hears Addresses by R. S. Hale and C. W. Abbott, but Expresses Fear of Undue Life and Fire Hazards of Proposed System

The Wednesday meeting of the Western Association of Electrical Inspectors, held at the Hotel Sherman, Chicago, this week, was characterized by a rapid-fire two-hour discussion of the advisability of indorsing the adoption of concentric wiring. Two papers on the subject—one by R. S. Hale of Boston, presenting the central-station view, favoring the introduction of concentric construction, and one by C. W. Abbott, an ex-inspector and a representative of the American Conduit & Manufacturing Company of Pittsburgh, giving views of the manufacturers of present fittings—summed up the general points in the situation.

An abstract of Mr. Hale's paper—which traced the history of the concentric-wiring movement, described the purposes of the proposed construction, and pointed out that the advocates of the concentric system are at present asking not that it be made to supersede existing methods but that its optional use be permitted—has been held, for lack of space, until next week.

Mr. Abbott said the supposed opposition of manufacturers to the adoption of concentric wiring is not based solely upon their opinion that such adoption would hurt their businesses. Rumors of the wonderful advantages of concentric wiring which floated about when the system was first proposed had, he said, made the manufacturers a little panicky and had created the impression, which still exists, that the manufacturers bitterly opposed the adoption of concentric wiring in America. They have no desire, continued the speaker, to stand in the way of any movement which is a step toward universal electric service. They do not believe, however, that adoption of concentric wiring is a step in the right direction, and they base their opinion upon advices received from Europe and upon the opinions of those familiar with electric material in practice.

What Will Insure Proper Grounding of Conductor?

"They ask the sponsors of concentric wiring," said Mr. Abbott, "what the janitors and the ten-year-old Thomas Edisons will do in making extensions with concentric wire. The manufacturers believe dangerous conditions are bound to result from the use of this wire by such people, particularly since it is not necessary to ground the concentric wire in order to make a lamp burn or a toaster toast; and even if grounds are originally made, the manufacturers deprecate the idea that they may be maintained, as some contend, by occasional re-inspections. Every American citizen thinks that the constitution guarantees him the right to tamper with his lighting system whenever he sees fit."

The speaker ridiculed the idea, therefore, that a small force of inspectors could maintain the systems properly grounded if the wire came into general use. He likened the conditions existing in the houses employing concentric wire to a group of homes, in each of which a stick of dynamite was hung by a string, the safety of the occupants depending upon occasional re-inspections of the string to see that it was not deteriorating. The manufacturers believe further, he said, that the wire will not be cheap when it is surrounded by some of the safeguards inspectors will demand.

Commenting upon the sample installation at the Hotel Sherman (pictured on page 244), Mr. Abbott said the work showed evidence of high mechanical skill on the part of the workmen who had constructed it. Yet, he continued, many of the bends employed were sharper than the 3-in. radius specified in the tentative rules for concentric wiring construction. To obviate the recurrence of such dangerous practices in everyday use of the wire he argued that labor of such high skill would need to be employed that all features of cheapness in the installation would disappear. He said further that he did not believe the sponsors of the system—the central stations—had carefully considered all phases of the problem or they would have realized that the accidents which will follow the adoption of the wire would wreck the carefully constructed and expensively obtained public opinion which has recently been built up in favor of the lighting companies. Reverting to the views of the manufacturers, the speaker declared it to be his belief that they were ready to co-operate with any other electrical interests in reducing the cost of electrical construction, and he asked that the manufacturers be given a chance to work out some cheaper system meeting all the essentials of the present code but not including the dangers which the manufacturers see in the adoption of concentric wiring.

Many Inspectors Regard Proposed Wiring as Hazardous

It seemed to be the almost unanimous opinion of the inspectors who spoke in the discussion that the use of concentric wire would introduce undue life and fire hazards. Among those who spoke were men from Texas, Minnesota, Ohio, Illinois and many other States. The queries they propounded and the objections they raised were answered or explained by S. E. Doane of Cleveland, H. B. Gear of Chicago and R. S. Hale of Boston.

The remarks of V. H. Tousley of Chicago summarized concisely what seemed to be the general opinion of the inspectors. He said the fact that concentric wiring has proved successful in Europe does not augur its success in America, because the American citizen and the European citizen are such widely varying types. In Europe the common person has a wholesome respect for the majesty of the law; the American citizen always does as he pleases, regardless of the law. For this reason, he said, railroad and other accidents

are less frequent in Europe because people respect laws such as those which forbid them walking on the tracks. American citizens walk on the tracks as they see fit, in spite of the laws. Mr. Tousley contended further that adoption of concentric wiring would not appreciably decrease the cost of serving the small customer, and he contended that the sponsors of the system should first see to it that the costs of pole-line construction, service connections, metering equipment and the like were reduced, and then approach the subject of cheaper interior wiring.

Dr. E. B. Rosa of the National Bureau of Standards, Washington, D. C., at the first day's session, spoke of the work of the bureau on the National Safety Code, describing the history of the movement and making a plea to the inspectors for their assistance in seeing that the provisions of the code are carried out if it is adopted. He predicted that the code would be printed for adoption in about two months, and stated that during its first year in force its adoption would be tentative. He hoped, he said, that during the first year inspectors would carefully watch its application in practice and suggest such changes as seemed necessary.

The Refillable Fuse Situation

H. E. Clifford, consulting engineer, and Gordon McKay, professor of electrical engineering at Harvard University, speaking on the present fuse situation, likened it to the one that existed twelve years ago, when there were no fuses or fuse blocks of standard size, with the result that the customer paid more than was necessary for his fuse equipment and many times used improper fuse material, introducing a hazard.

The question which now confronts the fuse industry is: Shall a fuse that cannot be refilled be made standard, or shall a fuse that can be easily refilled be made standard? The adoption and strict adherence to one of these principles would perhaps minimize the tendency to tamper with the product. The all-important question is which plan shall be adopted. Test results in this instance can be only indicative, and nothing but experience in the field can determine the real fitness of fuse apparatus. In this connection the speaker commented upon the recent decision of the Bureau of Standards wherein it was recommended that the continuation and extension of the use of Economy renewable fuses be permitted by the municipal and Underwriters' inspection departments, under conditions where their performance can be observed by each inspection department, until sufficient experience regarding their performance under service conditions can be obtained to justify unqualified approval or refusal to approve.

Mr. Clifford said further that the code specifications under which fuse tests are now conducted are very incomplete and that they make no mention of the amount of reactance to be used in the circuit and hence do not clearly define the conditions under which the tests are to be made.

Annual Meeting of Society for Electrical Development

The board of directors of the Society for Electrical Development held its annual meeting at the offices of the society in the Engineering Societies Building, New York, on Monday. General Manager Wakeman's annual report was read and accepted, and a budget of $100,000 for the 1916 expenditures was approved.

A committee was appointed to formulate plans for the work of the society during 1916, and with it rest the plans for another "electrical week," which it is quite probable will be held this fall.

It was decided to hold a 1916 house-wiring campaign, the plans for which are under way. In connection with this campaign another meeting will be held next Monday at the society's headquarters at 10.30 a. m. The society will work in co-operation with the manufacturers, central stations and others interested in a centralized house-wiring campaign to bring about an intensive movement within the industry.

Plans were formulated for the co-operative work to be carried on by the society during the year.

A special committee was appointed to co-operate with the National Electric Light Association, the Associated Manufacturers of Electrical Supplies, the Electrical Supply Jobbers and one trade press representative with the object of bringing about more intensive work in communities where the commercial development has been slow.

A committee composed of J. M. Wakeman and Ell C. Bennett was appointed to further a development of field activities by the Society for Electrical Development and the Jovian Order working in co-operation.

Midwinter Convention of the Illuminating Engineering Society

The midwinter convention of the Illuminating Engineering Society will be held in New York City at the Engineering Societies Building on Feb. 10 and 11. At this time the society will celebrate the decennial of its existence.

The list of the papers to be presented will be a review and record of what has been accomplished in the art and science of illuminating engineering, and it is expected that the discussion will bring forth plans for the future advance of the art. From this discussion the society expects a year of greater activity than ever before in all the fields that have been covered.

The feature of the convention will be the acceptance of an honorary membership in the society by Thomas A. Edison, who will receive this honor at a banquet to be tendered to him at the Biltmore Hotel on Thursday evening, Feb. 10. An entertainment program is being arranged to follow the banquet.

The committee has invited ladies especially to this convention, and arrangements are being made for their entertainment. Among other features a luncheon will be given at the Biltmore Hotel to visiting ladies on Thursday noon, when a special exhibition of ice skating will be arranged.

On Friday afternoon a popular lecture will be given by W. D'Arcy Ryan, the designer of the lighting of the Panama-Pacific Exposition. This will be illustrated by colored transparencies, which will convey more fully to those who did not visit the Exposition the wonderful lighting effects produced with color.

No provision has been made for a hotel or transportation committee, in view of the fact that the many hotels in New York afford a range in price and convenience which should suit all delegates.

The program as arranged for the convention follows:

Morning Session, Feb. 10.—Auditorium Engineering Societies Building. Address of welcome by John Purroy Mitchel, Mayor of the city of New York; response to address of welcome by Dr. A. E. Kennelly, professor electrical engineering at Harvard University; address of president by Dr. Charles P. Steinmetz; addresses by L. B. Marks, illuminating engineer and first president of the society; Dr. Hugo Munsterberg, psychologist, Harvard University; J. Lawrence Mauran, architect; Dr. F. Park Lewis, physiologist, and George B. Cortelyou.

Afternoon Session, Feb. 10.—Papers.

Evening Session, Feb. 10.—Hotel Biltmore. Address by Dr. Charles P. Steinmetz; presentation of honorary membership to Thomas A. Edison by John W. Lieb, followed by an address by Dr. A. E. Kennelly.

Morning Session, Feb. 11.—Papers.

Afternoon Session, Feb. 11.—Papers and a popular address by W. D'Arcy Ryan, entitled "Lighting of Panama-Pacific Exposition."

The program of papers to be presented at the technical sessions is as follows: "Relation of Lighting to Architectural Interiors," by Prof. Morgan Brooks; "Candle-Power Measurements of Series Gas-Filled Incandescent Lamps," by Ralph C. Robinson; "Theater Lighting," by Bassett Jones; "Illuminating Engineering Photographs," by B. H. Norris; "Lighting of the General Offices of the Consolidated Gas and New York Edison Companies, Consolidated Gas Building, New York City," by Thomas Scofield and Clarence L. Law; "Gas Lighting of a Large Cathedral in Philadelphia," by J. D. Lee; "An Interlaboratory Photometric Comparison of Glass Screens and of Tungsten Lamps, Involving Color Differences," by G. W. Middlekauff and J. F. Skogland; "An 'Average Eye' for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality-of-Brightness Photometer," by E. C. Crittenden and F. K. Richtmyer; "An Integrating Sphere," by E. B. Rosa and A. H. Taylor; "The Box Photometer," by Prof. L. O. Grondahl.

President to Urge a Tariff Commission

It is said in Washington that the bill which was introduced early in the present Congress by Representative Longworth of Ohio (Republican) providing for a tariff commission may be passed, or at least that it will be the basis for debate and action by Congress looking to the creation of such a commission, with the approval of President Wilson.

President Wilson is understood to have reached a decision to ask Congress to create such a commission, and it is said that he has changed his mind as to his once expressed opinion that the Federal Trade Commission has all the powers necessary for a tariff commission. At a recent session of the Senate many Senators advocated a tariff commission, among them Senators Newlands, Owen, Shafroth, Sutherland, Gore, Works, Smoot and others.

The President, it is said, now desires a broad-gaged commission, with power to act, to keep foreign goods from being "dumped" into the United States after the war in Europe. It is said that he will outline his views on the subject at the coming meeting of the Chamber of Commerce of the United States on the night of Feb. 10.

Mr. Longworth's bill does not give any power to act against foreign goods which there might be reason to suppose were being "dumped" on the United States, but he and his friends believe that an amendment could easily be placed in the bill which would give the necessary powers. The bill provides for a commission of five members, at salaries of $7,000 a year for four and $7,500 for the chairman, all of them eventually to have six-year terms. Power is given to require the production of papers and books of manufacturers but the bill prohibits the making public of information that would be of value to business competitors.

The duties of the commission are outlined as follows:

"That it shall be the duty of said commission to investigate the cost of production of all articles which by any act of Congress now in force or hereafter enacted are made the subject of tariff legislation, with special reference to the prices paid domestic and foreign labor and the prices paid for raw materials, whether domestic or imported, entering into manufactured articles; producers' prices and retail prices of commodities, whether domestic or imported; the condition of domestic and foreign markets affecting the American products, including detailed information with respect thereto, together with all other facts which may be necessary or convenient in fixing import duties or in aiding the President and other officers of the government in the administration of the custom laws, and said commission shall also make investigation of any such subject whenever directed by either house of Congress."

A. I. E. E. Midwinter Convention

The fourth midwinter convention of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, 33 West Thirty-ninth Street, New York City, Feb. 8-9.

There will be four technical sessions, morning and afternoon, on Tuesday and Wednesday, and a dinner-dance at the Hotel Astor on Tuesday evening. The technical program is of a diversified character and includes a variety of subjects which will insure wide interest. The meeting of the board of directors will be held at the Institute headquarters on Wednesday afternoon at the close of the technical session.

The Institute midwinter convention will be followed by a convention of the Illuminating Engineering Society in the same building on Feb. 10-11, 1916, the dates of both conventions having been decided through cooperation of the two societies for the convenience of members who desire to attend both.

The program of papers to be presented at the A. I. E. E. convention follows:

Tuesday Morning.—"The A. I. E. E. and the Technical Committee," by D. B. Rushmore; "Municipally Operated Electric Utilities of Western Canada," by A. G. Christie.

Tuesday Afternoon.—Symposium on high-voltage measurements: "Crest Voltmeters," by Clayton H. Sharp and E. W. Doyle; "The Crest Voltmeter," by L. W. Chubb; "The Voltmeter Coil in Testing Transformers," by A. B. Hendricks, Jr.; "Notes on the Measurement of High Voltage," by William R. Work.

Wednesday Morning.—Symposium on electric railway operation: "Operation on the Norfolk & Western Railway," by F. E. Wynne; "Chattering Wheel Slip in Electric Motive Power," by G. M. Eaton; "The Liquid Rheostat in Locomotive Service," by A. J. Hall.

Wednesday Afternoon.—"Method of Determining the Correctness of Polyphase Wattmeter Connections," by W. B. Kouwenhoven; "The True Nature of Speed," by John B. Flowers.

Government Ownership Debate in Congress

A resolution which was offered in the Senate by Senator Newlands providing for a joint congressional investigation into interstate and foreign commerce has "struck a snag," following an attempt made during the debate by Senator Borah and others so to amend it that the investigation would be extended specifically to include the question of government ownership.

The resolution is one that was introduced following the message read to Congress in December by President Wilson, in which he recommended that the transportation systems of the country be looked into. It was understood at the time that the President had in mind the possibility of ascertaining what could be done to aid the transportation systems, and that he had no idea of government ownership or regulation investigations.

Senator Newlands during the debate on the resolution was willing that it should be so phrased as to cover an inquiry into government regulation, but, he said, to agitate the question of government ownership at this time would not be wise and would have the effect of producing uncertainty in the business world.

The resolution was therefore not amended to include government ownership as suggested by Senator Borah. It was laid aside in the Senate, upon the objection to its passage by Senator Norris that any investigation of the railroads would necessarily be a lengthy one. It is understood in Washington that the question of amending the resolution to include government ownership will come up again.

Electric-Range Sales Booming at Boston

Since Oct. 1, 1915, the Edison Electric Illuminating Company of Boston has sold 211 electric ranges, and the popularity of this equipment is rapidly increasing, in large measure because of the 2-cent energy rate applying to the larger portion of the consumption of such

ELECTRIC RANGES FOR BOSTON APARTMENT HOUSE

units. A striking evidence of this development is shown in the accompanying halftone, illustrating a 5-ton electric truck loaded with no less than thirty-six ranges, all destined for the "New Beacon Apartments," the latest Boston-Brookline establishment to be completed for residence uses. W. Graydon Stetson, superintendent of the Edison appliance department, stated this week that no other type of range than the electric could have been successfully used in these apartments, on account of their arrangement and space requirements. The thirty-six suites in this building are each equipped with two meters, one for lighting and one for cooking service, all the meters being mounted on a single service board in the basement. In some of the suites the electric range is mounted on a sheet-iron shelf supported by angle irons on the inside of a closet door, there being no separate room for cooking in these instances. When not in use, the range is swung out of sight behind the door. The ranges in the "New Beacon Apartments" add about 182 kw. to the Edison company's connected load and are of Westinghouse and Globe make.

About 540 electric ranges are now in use on the Edison system, and builders are specifying them for individual houses. W. J. MacDonald, Boston, has just installed eighteen electric ranges in as many houses newly completed; twenty ranges have been provided by the Old Colony Real Estate Trust for separate homes, and the Wadsworth interests have also selected this method of cooking in new apartments. Sixteen different makes are represented in the Edison range sales since the fall opened. Highly significant is the fact that Mr. Stetson is in receipt of letters inviting investigation from no less than fifteen manufacturers of gas ranges who have seen the handwriting on the wall and begun to develop or produce electric ranges for the market they see coming.

The National Security League Convention

William Barclay Parsons of New York delivered an address in Washington last Saturday at the convention of the National Security League on "The Development of Auxiliary Forces of Reserve Officers Drawn from the Professional Class," in which he urged the establishment of an engineer reserve corps by the United States similar to the already established medical reserve corps.

Mr. Parsons said it was his good fortune to be able to present "a definite move for a definite detail of national defense." He told of the steps taken last spring by five national engineering societies of the United States, when separate committees were appointed to consider the problems involved, out of which grew a joint committee representing 26,000 engineers of the United States. He pointed out the small number of engineer officers in the United States army—210—and paid a tribute to their high character for engineering skill and their experience, at the same time declaring that in number they would be totally inadequate should a serious situation arise to demand their services. He described the British organization, telling how inadequate that was found to meet conditions when Great Britain went to war and how the engineer corps had to be heavily increased.

Confining his attention to the engineers in the proposed reserve, Mr. Parsons said the men could be selected as the President or Secretary of War would dictate. They could be classified geographically and professionally; that is to say, according to the particular line in which their experience lay, so that the War Department would know where to call for men especially versed in all kinds of construction.

The convention of the National Security League drew to Washington more than 1000 business and professional men from all over the United States. Addresses were made on the subject of the necessity for increased military preparedness for the United States by such men as Frederic R. Coudert, Dr. David Jayne Hill, former Ambassador to Germany; Robert Bacon, former Ambassador to France and former Secretary of State; John B. Stanchfield of the New York bar; Luke E. Wright, former Secretary of War; George von L. Meyer, former Secretary of the Navy; Samuel Gompers, president of the American Federation of Labor; Elihu Root, former Secretary of War and former Senator; Henry L. Stimson, former Secretary of War; George W. Wickersham, former Attorney-General, and others.

Large Plant for Sale of Energy in Bulk

Work has been started on the foundation and tunnels of a large steam plant under the management of the American Gas & Electric Company at Windsor, 15 miles from Wheeling, W. Va., where one of the company's subsidiaries, the Wheeling Electric Company, is situated. Tunnels are now being put in to take care of an ultimate rating of 180,000 kw. The tunnel and foundation work is being done by the Foundation Company of New York City.

The present plans, which will necessitate an outlay of approximately $2,500,000, call for two 30,000-kw. turbine-driven units, with another similar unit to be

installed soon afterward. The turbines will be furnished by the General Electric Company.

Five Babcock & Wilcox boilers, working at 250 lb. pressure and having approximately 12,625 sq. ft. heating surface each, will be installed. Each boiler will be equipped with a superheater working at a maximum of 250 deg. Fahr. of superheat. The stokers, condensers, boiler-feed and service pumps will be furnished by the Westinghouse Electric & Manufacturing Company and the economizers by the Sturtevant company. The engineering work is in charge of Sargent & Lundy of Chicago.

The American Gas & Electric Company has purchased about 110 acres of land, part of which has been set aside for the new plant and the remainder for factory sites. Already the Whittier, Glassner Company has purchased 400 to 500 acres adjacent to the plant, where there will be erected a large new steel-rolling mill.

A double-steel-tower, 130,000-volt transmission line will be built to Canton, Ohio, costing approximately $1,000,000. The right-of-way for this line has been secured and work will start shortly. It is expected to have this line in operation by the first of next July. The American Bridge Company has the contract for furnishing the steel for the tower and the Riverside Bridge Company for supplying the steel for the new plant. The construction of the line to Canton will be under the supervision of Frank Howard, superintendent of distribution at Wheeling.

Other lines, the number of which has not been definitely decided, will be run from the plant at a pressure of 66,000 volts and will connect with the present Wheeling distributing system.

The plant will supply only large consumers of energy and will not serve any domestic load except through the distributing system of some other company. A contract has been made for the purchase of all coal requirements for the next forty-five years at a very satisfactory figure. The mouth of the mine is right beside the plant.

Central-Station Gains in a War-Order Zinc-Mining District

Great Increase in Earnings in Joplin, Mo., as a Result of Demand for Zinc at High Prices

Amazing figures of growth are shown by some central stations as a result of an increased demand for energy by consumers who have "war orders." One of the typical instances is that of the properties in the zinc-mining district of Joplin, Mo.—the Empire District Electric Company and the Ozark Power & Water Company. The former company is controlled by the Cities Service Company, and both of the properties are operated by the Doherty Operating Company.

The extent of the great change which has been wrought in the position of these companies by the unprecedented activity and prosperity in the Joplin district, due to the large demand for zinc at high prices, is shown by the accompanying table. In December, 1915, the gross earnings of the Empire District Company showed a gain of 84.1 per cent over the record for December, 1914; the kilowatt-hour output for the month gained 103.8 per cent. In the calendar year 1915 the gross earnings of the company were 41.2 per cent greater than in 1914; the kilowatt-hour output was 52.2 per cent greater. The maximum load reached in December, 1914, was 11,655 kw. In December of the following year it was 21,550 kw.

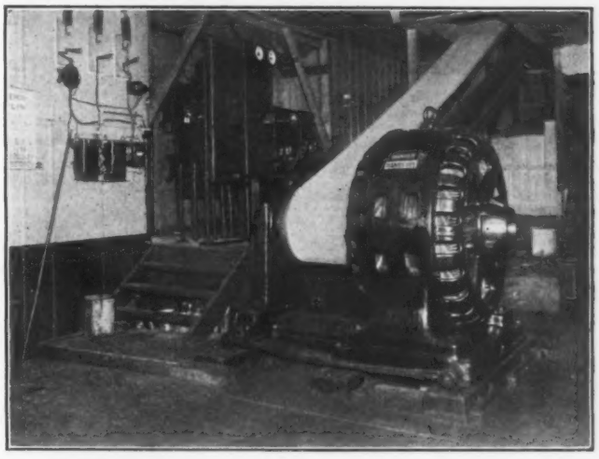
The contrast between the 1914 and 1915 results of operation of the Ozark company was even sharper, owing to the fact that the earnings of this property in the earlier year were below those shown normally. The earnings for December, 1915, increased 242.6 per cent over those of December, 1914; the gain in kilowatt-hour output in the same period was 377.3 per cent. In the entire year 1915 the earnings were 73.5 per cent above those for 1914, and the kilowatt-hour output was 87.8

ELECTRICALLY OPERATED ZINC MILL IN JOPLIN DISTRICT

per cent higher. The maximum load in December, 1915, was 10,800 kw., as compared with 10,150 kw. in December, 1914.

The large gains which these figures indicate come mainly from the increased demand for energy in zinc mines, although the unparalleled activity in that industry has also stimulated consumption by the other classes of consumers. The power business of the company as a whole furnishes about 80 per cent of its total earnings.

In preparation for the large business which it anticipated from zinc mines even under normal conditions, the company built line extensions five years ago which entirely covered the district. When the unprecedented demand for zinc developed almost directly after the beginning of the war, therefore, the company did not have to construct additional lines. Within six months from the time the European war was started the price of zinc ore rose from $36 per ton to $100 per ton. Since then it has gone as high as $135 per ton, and the present market price is about $110 per ton. The normal export business to England and the usual domestic demand were succeeded by enormous buying orders from brass manufacturers and from foreign buyers. The situation was accentuated by the closing of Mexican mines and the destruction of Belgian mines and smelters by the Belgians before the oncoming German invasion.



TYPICAL MOTOR DRIVE IN JOPLIN ZINC MILL

Under the stimulus of the high prices the mines which can secure sufficient energy are being operated continuously with three shifts of men. A number of contracts for limited service have been made. For the last four months some of the mines which could not get a supply of energy otherwise have been operated for twelve hours

per day, or from 6 o'clock at night to 6 o'clock in the morning. They thus take the load released by the stoppage of the demand from stone quarries at Carthage, which are served through the daylight hours by the Empire District company. The consequence of the demand for all of the energy which the company has at its disposal is that it has stopped soliciting business, and some of the power salesmen have been transferred to other properties controlled by the Cities Service Company.

Supplementing the 25,000 kw. produced at its steam station in the Joplin district, the Empire District company purchases 8000 kw. from the hydroelectric plant of the Ozark company. The latter company has marketed or contracted to market all of its supply of energy. In order to provide additional facilities the Empire District company has purchased a second-hand turbine from the Edison Electric Illuminating Company of Brooklyn. The rating of this turbine is 6000 kw., but it has carried a load of 9000 kw. to 10,000 kw. The company figures that this turbine will pay for itself in three months. It was found to be impossible to obtain prompt delivery of a new turbine, and in view of the great demand which confronted the company, the only alternative was

MONTHLY GROSS EARNINGS AND KILOWATT-HOUR OUTPUT OF COMPANIES IN THE JOPLIN ZINC-MINING DISTRICT

	Gross Revenue		Output: Kilowatt-Hours	
	1914	1915	1914	1915
Empire District Electric Company:				
January	$68,703	$63,091	4,986,309	4,891,960
February	62,119	63,231	4,500,210	4,873,510
March	66,017	71,403	4,961,000	5,784,815
April	60,859	70,828	4,668,950	5,583,570
May	56,437	73,324	4,310,490	5,942,065
June	55,796	81,151	4,231,617	6,532,920
July	56,688	82,499	4,233,141	6,822,760
August	57,155	96,608	4,434,955	8,109,320
September	58,755	98,000	4,385,607	7,893,980
October	60,718	102,377	4,658,572	8,497,665
November	59,015	106,227	4,547,663	8,675,780
December	61,751	113,711	4,612,870	9,402,638
12 months	$724,013	$1,022,450	54,531,384	83,010,983
Ozark Power & Water Company:				
January	$11,967	$10,509	3,681,095	2,965,200
February	12,039	13,423	3,861,600	4,410,400
March	12,128	14,078	3,880,400	4,651,100
April	11,274	14,730	3,407,400	5,160,100
May	11,471	13,465	3,481,200	4,515,000
June	5,776	14,534	939,700	4,980,700
July	7,213	11,074	1,571,600	3,167,200
August	5,569	11,348	806,900	3,089,500
September	8,040	15,226	1,960,500	4,230,300
October	5,705	19,257	836,700	3,826,200
November	5,362	18,198	667,200	2,796,400
December	6,909	23,670	1,155,500	5,515,000
12 months	$103,453	$179,512	26,249,795	49,307,100

the purchase of a second-hand machine. In order to provide for the turbine which has been purchased the Empire District company will build an addition to the power station which it built five years ago. The addition will add about 50 per cent to the size of the structure. Construction work is now under way.

While the rate under the schedule for zinc mines is low, it is practically a continuous load under present conditions. The schedule provides for a sliding scale, according to the consumption. In addition the company furnishes part of the energy for two interurban roads which traverse the district and provides general service in the cities of Joplin, Webb City and Carthage, Mo., and in Galena and Columbus, Kan. The accumulating wealth which is transforming the district may be indicated by the statement that the normal price of zinc ranges from $30 to $40 per ton. Labor troubles have been averted by agreement of the mining companies to base wages on a market price of $40 per ton, with an increase in proportion as the price of zinc advances above that quotation. This means that many miners receive from $5 to $8 per day.

Federal Water-Power Legislation

Senate Committee Offers a Substitute Measure for Ferris Bill—National Conservation Association Prepares Active Campaign to Combat Movement

The public lands committee of the Senate has reported to that body a substitute for the Ferris water-power bill recently passed by the House of Representatives. The substitute recognizes both state and federal jurisdiction over water-power sites in the United States and directs that all interstate business in connection with water-power grants shall be under control of the Interstate Commerce Commission, leaving to the respective states the regulation of intrastate business. The leasing period, fifty years, is the same in both bills, but the Ferris bill gives the federal government at all times full control and regulation of projects.

The indication in this substitute bill, as well as other indications, points to the fact that there is to be a prolonged debate and many parliamentary skirmishes over the passage of this and the other water-power measures before Congress, a situation made still more likely, according to reports from the representative of the ELECTRICAL WORLD at Washington, by the report on water-power subjects recently sent to the Senate by the Secretary of Agriculture claiming monopoly in water-power developments on the Pacific Coast.

Furthermore, bulletins being issued in Washington by the National Conservation Association, of which Gifford Pinchot is president, are being so phrased that there is an intimation that if bills are passed in Congress not satisfactory to the conservation element represented by the association attempts will be made to have President Wilson veto them. A recent bulletin issued by the association (Jan. 25) quotes the language of President Roosevelt when he vetoed the James River Dam bill January, 1909, in which he said of corporations interested in water-power:

"They pay no attention to state boundaries and are not interested in the constitutional law affecting navigable streams except as it affords what has been aptly called a 'twilight zone,' where they may find a convenient refuge from any regulation whatever by the public, whether through the national or state governments."

These words, the conservation association's bulletin of Jan. 25 says, "could equally apply to the situation to-day," and it is announced that Congress and the press are to be supplied with further bulletins outlining the association's attitude.

The Shields bill, providing for the development of water-powers on interstate streams, has been favorably reported. It is on the Senate calendar and may come up at any time. This bill is similar to the Adamson bill in its more important particulars. The latter passed the House at the last Congress and has been reintroduced in the present House with some changes. As the Adamson bill now stands it is approved by the conservationists. There may be additional hearings granted on the newly introduced Adamson bill.

In the report of the Senate committee on public lands on the substitute for the Ferris bill submitted by Senator Myers, it is said:

"The bill distinctly recognizes the ownership of and the right of control in the states of the use of the waters in the flowing streams of the states. In cases where latent power is going to waste in the streams of the states and where the land adjacent thereto and neces-

sary for the location of power sites belongs to the United States government this measure recognizes that there must be co-operation between the states which control the water and the United States government, which owns the land. Neither alone can successfully develop water-power.

"The bill in no wise seeks to encroach upon, impair or destroy any of the rights of the states. It is not intended in any wise or in any degree to trench upon the right of the state to the control of the water flowing in the streams within its borders."

Seattle Needs More Electricity

A Number of Sites Which Can Be Paid for with Utility Bonds Are Offered to City

J. B. Ross, superintendent of lighting for the city of Seattle, Wash., has submitted to the Mayor and City Council a report on the needs of further electricity for the city lighting system. The present hydroelectric plant at Cedar Falls delivers approximately 9600 kw. in Seattle, and the steam plant on Lake Union is capable of producing a maximum of approximately 10,000 kw. Although the latter plant was intended primarily as an emergency plant, it is now carrying 2750 kw. regularly. In order to meet the growing demands on the municipal system it is estimated that a plant of 22,500 kw. should be installed soon.

Although water-power in the State of Washington is plentiful, yet large water-powers that will give good permanent service at reasonable cost are comparatively few. Some large sites worth developing that lie within a 100-mile radius of Seattle are given in the report as follows:

Skagit River—200,000 kw.
Elwha (four plants)—50,000 kw.
Sauk-Suiattle (one plant)—50,000 kw.
Cushman site (one plant)—40,000 kw.
Packwood Lake (one plant)—30,000 kw.
Skyhomish River (two plants)—30,000 kw.
Deer Creek—18,000 kw.

The great majority of the developments are in the government reserve, and the largest of them, that on the Skagit River, was filed on some time ago by the Puget Sound Traction, Light & Power Company of Seattle.

As is probably well known, the Cedar River basin of the municipal system will not hold water, and the question of the method of sealing it is now still under discussion and investigation. It is suggested that the building of a new plant at a location entirely different has several distinct advantages. The transmission lines will be independent and so not subject to trouble at the same time as the Cedar River plant from lightning, fires or other hazards. The conditions of floods or snowstorms will also be different, and the city will have an entirely independent source of supply, better guaranteeing continuous operation of the lighting system.

The Olympic Power Company, owning the Elwha plant, has offered to sell its present holdings to the city for 5 per cent utility bonds at par. The offer is for the sale of the entire holdings of the company, personal and realty, including all transmission lines, developed units and the undeveloped power sites at McDonald and Glines Canyon, and all contracts and good-will, the sum asked being $1,775,000. There are four sites on the Elwha which will permit a total economical development of 120,000 kw. on 50 per cent power-factor.

The Western Power Company has offered to construct complete and deliver to the city a 40,000-kw. development on the Deer Creek, with permanent flume, for $5,550,000.

John C. Eden has offered the city a 25,000-kw. development on the Skyhomish River, with sufficient water to operate continuously at 17,000 kw. and to carry a peak of 25,000 kw. for five hours a day, together with a transmission line, for $2,215,000.

The project on Packwood Lake has been offered by the Valley Development Company, which will build and sell to the city of Seattle a hydroelectric plant capable of delivering 25,000 kw. on the low-tension side of substation transformers, for $132 a kilowatt.

A number of other projects were considered, four of which were worthy of more than passing mention. As a guide to the comparison of the various plants the summary given in the table herewith was prepared.

The city of Seattle has filed on the water rights of the Cushman and Sauk-Suiattle projects, and the superintendent of the lighting department recommends that several of the best offers for a complete plant be further investigated without delay. If no new plant is to be in operation in the winter of 1917 or the following summer, it is recommended that during 1917 a 5000-kw. steam addition be made to the Lake Union plant to tide over the city until the water-power development is complete.

SUMMARY OF DEVELOPMENT COSTS AND COST OF POWER FOR VARIOUS WATER-POWER AND STEAM PLANTS. POWER COST FIGURED ON 40 PER CENT STATION FACTOR. POWER AT 15,000 VOLTS IN SEATTLE

Development	Kw. Delivered in Seattle	Miles Transmission	Total Cost	Cost per Kw.	Operation per Kw.-Hr., Cents	Depreciation per Kw.-Hr., Cents	Interest per Kw.-Hr., Cents	Fuel per Kw.-Hr., Cents	Total per Kw.-Hr., Cents	Total per Kw.-Year	Cost After Sinking Fund Retires Interest Charges	
											Per Kw.-Hr., Cents	Per Kw.-Year
Elwha	32,000	184	$4,018,700	$125.58	0.033	0.162	0.179	.....	0.400	$14.04	0.221	$7.76
Elwha	110,000	184	11,268,915	102.44	0.018	0.160	0.146	.....	0.332	11.61	0.186	6.49
Cushman	27,000	92	4,132,500	153.06	0.023	0.231	0.218	.....	0.472	16.54	0.254	8.89
Cushman	54,000	92	5,607,208	103.84	0.019	0.162	0.148	.....	0.329	11.52	0.181	6.33
Deer Creek	27,000	54	3,853,770	142.73	0.021	0.225	0.204	.....	0.450	15.77	0.246	8.63
Deer Creek	40,000	54	4,568,220	114.21	0.024	0.183	0.163	.....	0.370	12.94	0.207	7.23
Packwood Lake	25,000	93	3,463,900	138.55	0.025	0.217	0.198	.....	0.440	15.40	0.242	8.47
Packwood Lake	55,000	93	7,444,962	135.36	0.018	0.223	0.193	.....	0.434	15.21	0.241	8.44
Suiattle	30,000	75	4,315,000	143.83	0.020	0.246	0.203	.....	0.471	16.52	0.266	9.33
Sauk-Suiattle	125,000	75	16,000,000	128.00	0.014	0.219	0.183	.....	0.416	14.57	0.233	8.17
Hebb	30,000	45	5,177,000	172.57	0.019	0.238	0.246	.....	0.503	17.64	0.257	9.00
Hebb	45,000	45	6,600,000	146.70	0.021	0.213	0.209	.....	0.443	15.55	0.234	8.21
Steam plant in Seattle, oil at 80c	7,500	0	378,357	50.45	0.097	0.086	0.072	0.472	0.727	25.49	0.655	22.97
Steam plant, coal at $1.55	7,500	0	413,357	55.12	0.108	0.094	0.079	0.323	0.604	21.16	0.525	18.41
Steam plant, mill refuse at $1 per unit	7,500	0	418,357	55.78	0.119	0.095	0.080	0.313	0.607	21.45	0.527	18.46
Steam plant at mine, coal at $1 per ton	30,000	11	2,601,500	86.72	0.064	0.148	0.124	0.200	0.536	18.77	0.412	14.43

Electric Service in a Cotton-Duck Mill

Power and Lighting Equipment of Cotton Mill at Woodberry, Md.—Methods of Serving Motors and Lamps—Data on the Operating Requirements of Departments in the Mill

A LARGE remodeled cotton-duck mill operated by William E. Hooper & Sons at Woodberry, Md., now contains 119 motors of a combined rating of nearly 2000 hp. served from the system of the Consolidated Gas, Electric Light & Power Company of Baltimore. In what here follows the construction and layout features of the plant are presented, together with data covering the motor drives, control apparatus, mechanical transmission and mill equipment.

Three-phase, twenty-five-cycle, 13,500-volt energy is furnished this mill by the Baltimore company and is brought to the plant through underground cables which emerge in a transformer house, separate and distinct from the mill building. In this house, a portion of which is shown in Fig. 3, are installed three 400-kva., 13,500/550-volt transformers and one spare unit, a 100-kva., 13,500/110-volt lighting transformer, and the high-tension switching and instrument equipment. The conductors from the incoming cable fan out back of the high-tension switchboard and join disconnecting switches separated by barriers. From the switches jumpers lead to horizontally arranged busbars from which taps extend to a bank of single-pole oil switches set in concrete compartments. The 13,000-volt indicating, integrating and recording meters are shown on the panels in front of the oil switches. From the high-tension oil switches circuits extend through a tile-duct line which opens at one end of the transformer row about 9.5 ft. above the floor. There the cables connect with the transformer bus, which consists of insulated copper rods supported by insulators attached to a pipe framework.

Connecting the power transformers with the low-tension switchboard are two three-wire, three-phase feeders which terminate in disconnecting switches mounted on the rear of the board. This switchboard consists of one main and one feeder panel for lighting circuits and one main panel and five feeder panels for motor circuits.

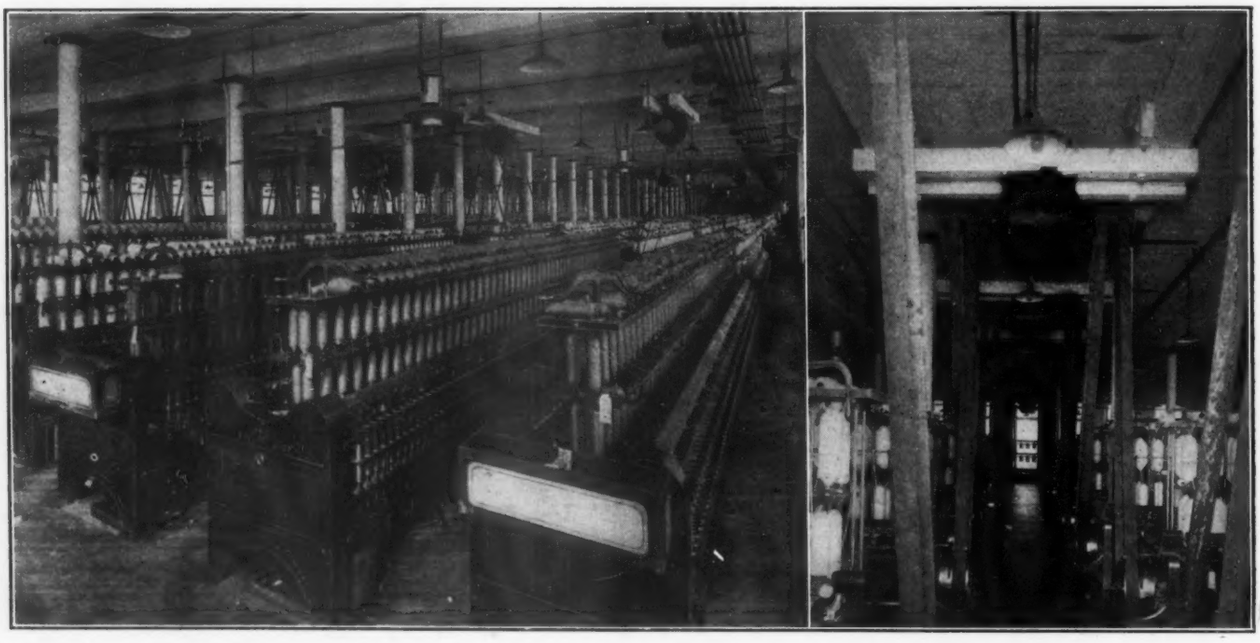
Main Switching and Metering Equipment

All energy for operating motors first passes through an oil circuit-breaker without time-limit relay but set to open when a serious short-circuit occurs. This switch energizes a bus to which are connected the sub-main oil switches. These are equipped with time-limit relays. On the same panel with the main oil switch are mounted apparatus for indicating grounds, an indicating voltmeter, and a combined indicating wattmeter and totalizing watt-hour meter. Attached to an adjacent panel is a recording voltmeter.

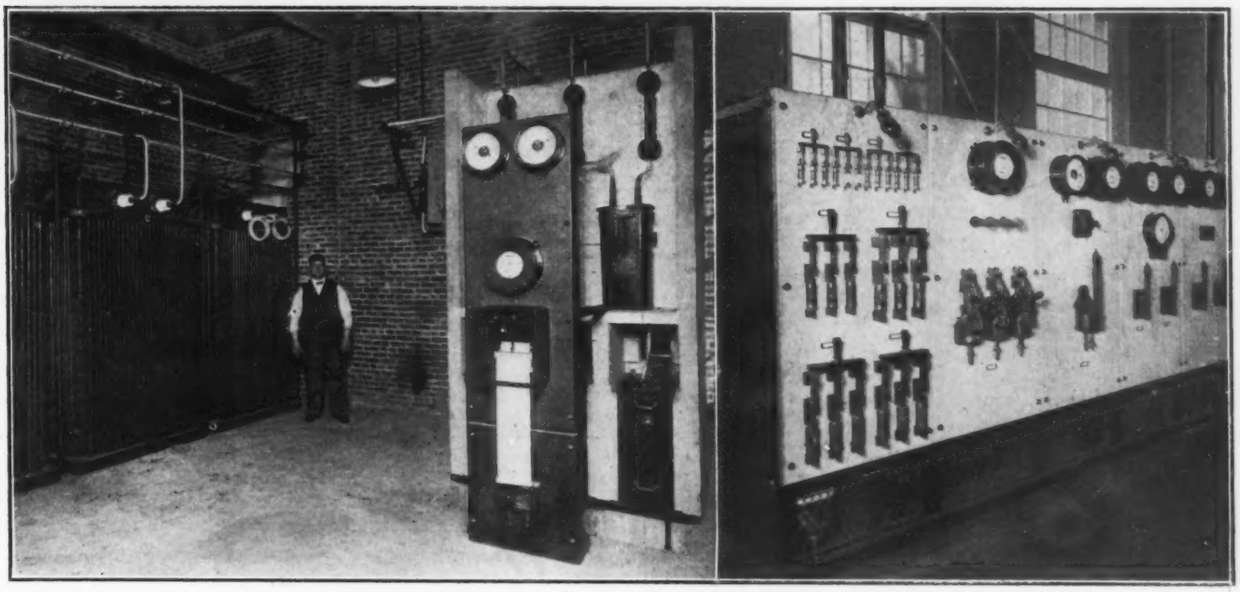
The lighting circuits are protected by a three-pole, individual-trip, independent-arm circuit-breaker. The lighting sub-mains are controlled by three-pole fused knife-blade switches. The main lighting panel is also equipped with an integrating watt-hour meter and pilot lamps for indicating grounds. Each motor sub-main panel is also equipped with an integrating watt-hour meter.

The circuits for serving the motors constitute the greater portion of the cotton-mill wiring installation. In general, a separate main is run in each department so that the amount of energy required for any particular operation can be accurately determined. As a rule, the motor mains terminate in centers of distribution, although in some cases where the number of motors grouped near one point is small the power main nearest the group is tapped and branches extended to the motors.

The majority of motors are rated at 15 hp. to 25 hp. and thrown directly on the line by textile switches when started without load. Where they are required to accelerate with a load, however, oil switches with time-limit relays are employed. In all cases each motor is protected by fuses. Where motors of large rating, such



FIGS. 1 AND 2—FOUR-FRAME MOTOR DRIVES IN SPINNING ROOM, SHOWING CUT-OUT BOXES AT THE SIDE OF CEILING RADIATORS AND (ON THE RIGHT) MOTOR STARTERS MOUNTED IN WINDOWS



FIGS. 3 AND 4—INTERIOR OF TRANSFORMER HOUSE, AND LOW-TENSION MILL SWITCHBOARD

DATA COVERING MOTORS, CONTROL EQUIPMENT AND MACHINES DRIVEN

Number and Hp.*		Speed, R.p.m.	Number and Size of Pulleys on Each Motor	Type of Starting Device†	Type of Machines Driven by Each Moto
Eight	10	1,420	Two 10.5x4x4	Textile, style 176,923	Lap breaker
Ten	7.5	1,420	Two 10.5x4x4	Do.	Lap finisher
One	5	705	One 7½x4x4	Do.	Two slubbers
Three	7.5	705	Two 7½x4x4	Do.	Four slubbers
Two	7.5	705	One 7½x5	Do.	Drawing frames
One	100	720	One 20.5x10x10	Auto starter, type E, style 148,201; O. L. and N. V. release, 151,646 A	Cards
One	125	720	One 20.5x10x10	Type Q, style 150,049; two auto transformers, style 10,315	Do.
Three	7.5	705	Two 9.5x4x4	Textile, style 176,923	Four-fly frames
Five	7.5	705	Two 8.2x4x4	Do.	Do.
One	10	580	One 17.2x5	Elevator switch, style 146,630	Elevator
Five	15	1,440	Two 9.1x6x6	Type H oil circuit-breaker, style 115,338 A; O. L. and N. V. release.	Four twisters
One	15	1,440	Two 9.5x6x6	Do.	Do.
One	25	720	Two 11½x6x6	Do., style 115,339 A	Do.
Two	25	720	Two 14½x6x6	Do.	Do.
Six	20	720	Two 17.75x6x6	Do., style 115,338 A	Do.
One	20	720	One 18 4/15x6x6; one 17.75x6x6	Do.	Do.
One		1,430	One 7.25x4x4	Auto starter, style 90,846; relay, 151,642 A; O. L. and N. V. release	Spooling frames
Three	20	1,440	Two 7½x6x6	Type H circuit-breaker, style 115,338 A; O. L. and N. V. release	Four spinning frames
Twenty-one	20	1,440	Two 9.1x6x6	Do.	Do.
One	10	1,420	One 7x5	Auto-starter, style 90,845; relay H 151,641 A	Fan-picker-room
Two	10	705	One 7½x5	Do.	Drawing frame
One	7.5	705	One 20x4; one 4½x2.5	Textile 176,923	Lap machine
One	5	1,420	One 6½x2.5x2.5	Do.	Spoolers
Three	30	1,430	One 12x4x4	Type E auto-starter; style, 148,799; relay, 151,643 A	Waste machines
Eight	5	1,420	One 7x4	Textile	Openers
One	5	1,420	One 7½x4	Do.	Do.
Two	75	480	One 21x10; one 17x10	Type E:1 auto-starter with relay	Looms
One	75	480	One 21x14	Do.	Filling winders
One	15	710	Two 12x6x6	Do.	Tube winders
Two	30	470	Two 15x8	Do.	Wick loom
One	5	700	Gear 74-T 6-P; pinion 39-T 6-P 1.5-in. face	Textile	Sewing machine
Two	3	700	Gear 64-T 6-P; pinion 34-T 6-P 1-in. face	Do.	Do.
One	10	710	Two 9x5	Auto-starter	Seamers
One	3	460	One 6x5	Textile	Printing press
One	10	710	One 9x7	Auto-starter	Starchers
One	50	470	One 20x8; one 18x8	Do.	Branders
One	20	470	One 11x6; one 16x6	Do.	Ballers
One	20	710	One 14x9	Do.	Seamers
One	5	705	One 6x5	Textile	Warpers
One	40	470	One 20x12	Auto-starter	Looms
Two	3	700	One 7x4	Textile	Beamers
One	10	1,420	One 8.75x8 (flat)	Auto-starter	H. beamer
Two	1	455	One 5.25x3	Textile	Warp mill
One	7.5	1,420	None	Auto-starter	Lathe
One	3	1,410	One 5½x4	Textile	Machine shop

*Total number, 119; total horsepower, 1982.5. †Types and style symbols refer to Westinghouse equipment.

as 100 hp., are used, auto-transformers are provided. Wherever feasible the starting devices have been grouped, usually in front of windows. Considerable care has been taken to make the installation as nearly fireproof as possible, special junction boxes having been provided over the terminals of various motors and starting devices so as to shield them from cotton and lint. The construction employed for inclosing connections between starting devices and feeders is similar to that shown in the accompanying illustration.

Practically every machine has an individual motor,

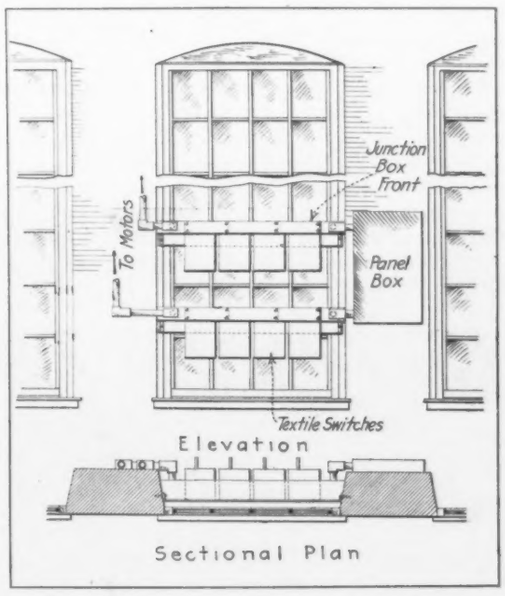


FIG. 5—ARRANGEMENT OF MOTOR STARTERS IN FRONT OF WINDOWS

the units as a rule being attached to ceiling beams in a straight line across the mill.

LIGHTING SYSTEM

Separate lighting feeders are run to each floor of the main mill and various outbuildings, where they connect with panel boxes. Two panels are provided on each floor of the main mill, so that only half of a floor is served on each panel. From these boxes two lines of conduit, each

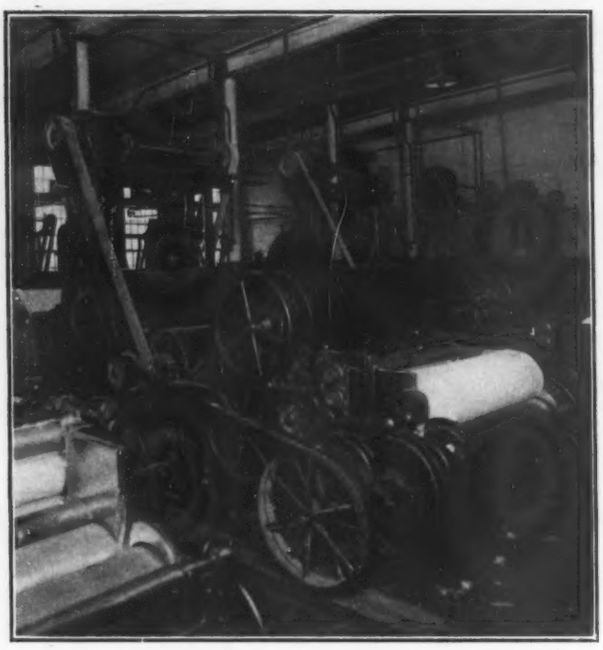


FIG. 6—MOTORS MOUNTED ON MACHINES AND OPERATING TWO BELTS

containing three-wire, three-phase sub-mains, extend in opposite directions. In each bay the sub-mains pass through an iron cut-out box having a hinged cover. Three double-pole main-line porcelain-fused cut-outs are installed in each box to protect the branch circuits fed therefrom. By this arrangement an evenly balanced system is maintained.

At each lamp outlet is a condulet fitting with a metal cover containing a nipple with a female thread. Into these nipples are screwed pipe pendants equipped with extensive-type steel reflectors. By extending the branch-circuit conductors down the pipe pendants and connecting with the socket terminals insulating joints were not required.

The fixtures are designed so that the steel reflectors are secured in position by screwing them into caps which are attached directly to their respective pendants. The caps were designed to fit all sizes of the type of reflectors used so that no change or disconnecting of fixtures will be required if differently rated lamps are substituted for those now in use.

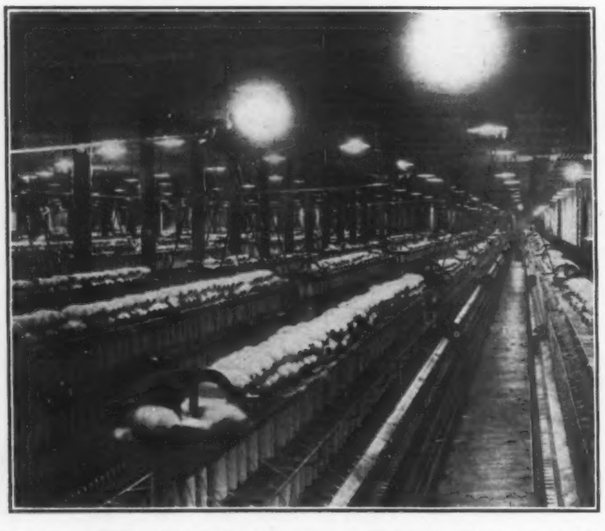


FIG. 7—NIGHT ILLUMINATION IN SPINNING ROOM OF WOODBERRY COTTON MILL

In providing illuminating equipment for this mill special attention was paid to the selection of reflectors and the spacing employed, so that the production of material would not be decreased, the quality of output impaired, or the number of accidents increased, as might happen with inadequate illumination. Porcelain-enameled steel reflectors were employed because they do not rust readily and do not collect dust, lint, etc. These latter qualities were considered especially conducive to minimum cleaning expense and constant reflective power. Extensive types of reflectors were used

ILLUMINATION INTENSITIES, TYPE OF REFLECTORS AND RATING OF LAMPS RECOMMENDED FOR COTTON-DUCK MILL

Operation	Foot-Candle Intensity	Lamp Rating, Watts	Type of Reflector	Mounting and Spacing
Receiving	1.2	....	.....	At ceiling for general illumination.
Opening and lapping machine	1.5	60 or 40	Extensive	One over each end of machine 8 ft. above floor.
Carding machine	2.0	60 or 40	Extensive	8 ft. above floor, staggered between machines.
Drawing frame	2.0	60 or 40	Extensive	8 ft. above floor, in front of machine on 8-ft. centers.
Roving, spinning and spooling	2.5	60 or 40	Extensive	8 ft. above floor in aisle on 7-ft. centers.
Warping	2.0	60 or 40	Intensive	One lamp over beam, one over inside reed, 8 ft. above floor.
Slasher	1.5	60 or 40	Extensive	One lamp over each end of machine 8 ft. above floor.
Drawing in	3.0	60	Extensive	General illumination 8 ft. above floor on 8-ft. centers.
Weaving	2 to 5	60	Extensive	In center of weavers' alley.
Dyeing	2.5	60	Extensive	Local or general illumination.
Inspection	7.0	....	.....	Color-matching light.
Packing	2.5	100	Extensive	General illumination 16-ft. centers.

for general illumination of floor areas and also for the localized general illumination of most of the machinery. Intensive-type reflectors were employed, however, over the smallest looms where the area to be lighted was relatively small and where high intensity was considered desirable.

In the above table are given the intensities of illumination, types of reflectors and locations which were recommended for this plant. Seventy-three of the extensive reflectors were equipped with 100-watt tungsten lamps and 611 were provided with 60-watt lamps. Fifty of the intensive reflectors were also equipped with 60-watt lamps. Some 250-watt lamps were employed, although not listed in the table.

EMERGENCY LIGHTING

For use in emergencies there have been provided at various points on all floors lamps which will give sufficient illumination to enable persons to see their way to elevators, stairs or fire escapes in case the central-station service is interrupted. These lamps are connected with circuits supplied with energy by small directly connected generator sets.

The conductors throughout the plant are inclosed in

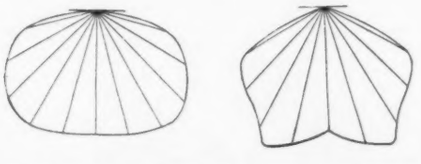
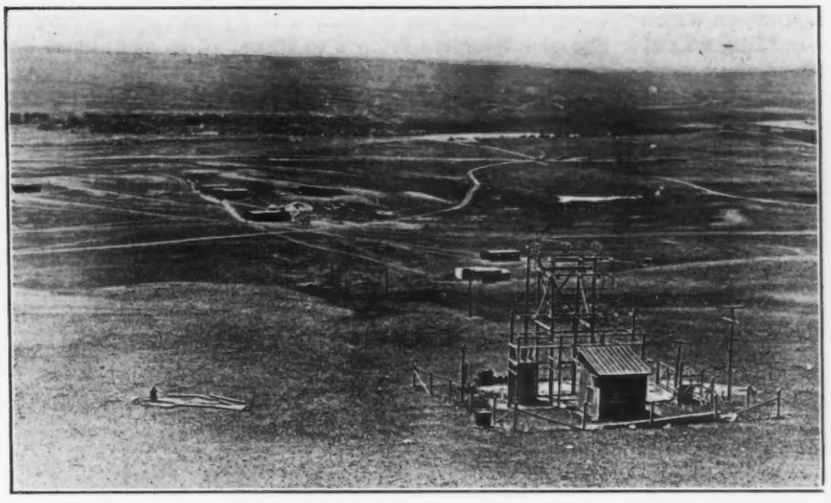


FIG. 8—DISTRIBUTION CURVES FOR THE EXTENSIVE AND INTENSIVE REFLECTORS EMPLOYED

iron conduit. The motors used in this plant were furnished by the Westinghouse Electric & Manufacturing Company, the reflectors by the Wheeler Reflector Company, and the entire installation, including that of switchboard, reflectors and lamps, was designed and carried out by the Keller-Pike Company, Philadelphia, Pa.



The Montana Power Company's transmission line from Rainbow Falls to the diversion dam at the upper end of the canal line is 75 miles long. Energy is transmitted at 48,600 volts over wires strung on 45-ft. cedar poles with a span length of about 350 ft. At three points on the canal power is delivered to substations of 700-kva. to 1600-kva. rating, where the pressure is reduced from 48,600 volts to 16,500 volts for distribution along the canal. The distribution line is carried on 30-ft. fir or cedar poles with span lengths of 150 ft. For transforming this 16,500-volt energy down to the voltage required by the motors two sets of transformers are used. One set, stepping from 16,500 volts to 2200 volts, is mounted on heavy trucks and hauled along by teams as the work proceeds. Connection is made to the 16,500-volt line at some convenient point and energy is transmitted at 2200 volts through a triple-conductor, steel-armored cable to the second set of transformers, which are mounted under the floor on the frame of the machine, and step the energy down to the motor pressure, 440 volts. The steel cable is about 1000 ft. long and obviates moving the high-tension connection at frequent intervals.

Canal Excavation with Electric Drag-Line Scrapers

Low Unit Cost for Excavating 1,500,000 Cu. Yd. in Two Seasons with Two Machines on Sun River Reclamation Service Project, Near Great Falls, Mont.

ELECTRICALLY driven drag-line scrapers have excavated economically a long canal on the Sun River project of the United States Reclamation Service, at a distance of from 8 miles to 20 miles from the nearest railroad from which fuel for steam-driven excavators could have been obtained. The low unit cost at which the material was handled makes the records herewith of special value to the engineer who has excavation jobs that are ordinarily executed with steam power on the job.

The project is situated immediately west of the junction of the Sun River with the Missouri at Great Falls, Mont. Construction of the first unit of the north side development involves the building of a 45-mile canal in heavy material. On account of the high cost of fuel for construction machinery it was determined by the engineers of the Reclamation Service to supplant coal with electricity from the nearby hydroelectric developments on the upper Missouri.

Early in the spring of 1913 arrangements were made with the Great Falls Power Company for the delivery of energy from its plant at Rainbow Falls to three points on the canal line, from which the energy could be distributed along the work as required by the type of equipment used.

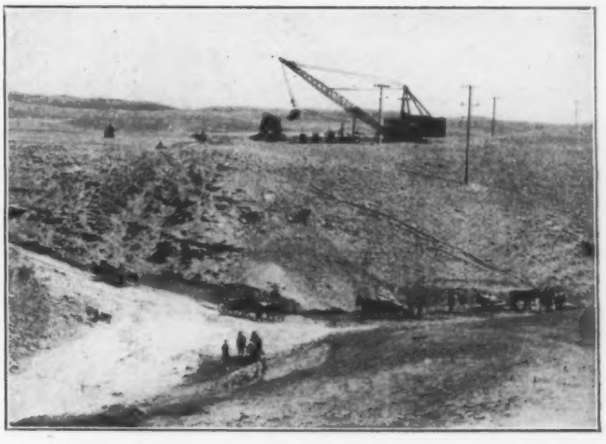
THE MOTOR-DRIVEN DRAG LINES

The contract for the excavation of the canals, stipulating that electrical energy should be used wherever power was required, was let to the MacArthur Brothers Company of New York. The contractor decided to use drag-line excavators for the major part of the work, subletting to team outfits such sections of the canal as could not be economically worked with drag-line machines. The larger of the machines, a Bucyrus class 24, is equipped with a 100-ft. boom and a 3½-yd. extra heavy Page bucket. The motors are of the slip-ring induction type, designed for heavy intermittent reversing service, and are wound for 440 volts. The main motor is 200 hp. and the swinging motor 115 hp. The machine is operated through a remote-control, solenoid-operated Cutler-Hammer switchboard, set at the rear of the deck-house and so arranged that it is impossible for the operator to overload the motors by improper handling of the levers. Brakes and frictions are air-controlled from a compressor run by a 2½-hp. motor in the rear of the house. The machinery is mounted on a heavily braced structural-steel frame, set on skids. The drag line is moved on rollers and timbers. The smaller machine is a class 20, similar in design to the larger one, but equipped with an 85-ft. boom and a 2½-yd. Bucyrus bucket.

The machines were hauled to the site of the work knocked down, and were erected in the field. Excavation was started in March, 1914, and has continued steadily ever since, with the exception of minor break-downs and the shutting down of the class 20 machine for three months during the winter of 1914-15. At the time the work was started the construction of irrigation canals in heavy material by electrically driven drag lines was more or less of an experiment, but the results have been far better than were expected, and this method of procedure has ceased to be experimental.

EXCAVATING ROADS FOR SIDE-HILL WORK

It was expected that the handling of the machines on side-hill slopes as steep as 2½:1 would be slow and probably dangerous. Whenever side hills were encountered the machines were used to excavate and level ahead



LOADING WAGONS IN CONSTRUCTION OF HIGH EMBANKMENT

of themselves a road from 30 ft. to 35 ft. wide, on which the timber track was laid. This advance grading was at such elevation as would produce the most efficient work of the bucket and still keep the track excavation within the lines of the completed canal, thereby rendering unnecessary any non-productive excavation by the machines. At several points on the canal the upper cuts were as great as 90 ft. By excavating the grade of the track 50 ft. above canal grade, however, the upper part of the slope was excavated without double handling of the material.

The material excavated varied from a gravelly loam to cemented gravel, glacial drift and sandstone, and the topography from a level prairie to a steep, rocky hillside with transverse slopes of 2½:1. In the heaviest material blasting was resorted to, but in several instances the machines have dug 8 ft. or 10 ft. of seamy sandstone without the use of explosives. About 1,500,000 cu. yd. of excavation has been handled by these two machines in two seasons, and costs are given here for some of the work, showing the nature of the material handled and the working conditions.

Amount of Electrical Energy Consumed

Energy consumption has varied from 0.8 kw.-hr. to 3.0 kw.-hr. per cubic yard of material moved. No attempt was made to obtain record-breaking outputs for the machines, as it was realized that with frequent moves, rough topography and the condition imposed of placing the material so as to produce a water-tight bank, outputs would not be comparable with those of machines working in a large pit and wasting the material or loading it into cars. Outputs of 1450 cu. yd. per eight-hour shift and 32,000 cu. yd. per shift per month have, however, been obtained under the above conditions. The crew required to operate a machine for one shift has comprised one operator at from $175 to $200 a month, one oiler at $2.50 a day, four trackmen at from $2 to $2.50 a day, and one team to move track timbers, etc. Electrical work for all shifts has been performed by an electrician or electrical foreman, who has received from $150 to $175 a month.

Interest on investment includes all charges for insurance, bond premium and interest on cash capital required. Preparatory expense includes all charges for the delivery and installation of plant and accessories. Plant depreciation includes all charges for repairs and depreciation of tools and machinery. Under the classification adopted for excavation, class 1 includes all material that can be plowed to a depth of 6 in. with six animals of 1400 lb. or over, and boulders of less than 2 cu. ft.; class 2 includes indurated material that cannot be plowed to a depth of 6 in. with six animals, but after being loosened can be excavated by teams and scrapers, and also boulders from 2 to 10 cu. ft. in size; class 3 is rock in place not included in classes 1 and 2.

Costs for the class 24 drag line are for the construction of 2 miles of canal on heavy side hill and ½ mile of canal entirely in cut. The sections excavated were from 12 ft. to 22 ft. in bottom width with side slopes of 1:1 and 1½:1. Costs include the hand trimming of 9000 ft. of the canal for placing concrete lining.

TABLE I—EXCAVATION COSTS IN CENTS PER YARD WITH CLASS 24 ELECTRIC DRAG LINE VALUED AT $36,326.63

Item	Class 1, 333,689 Cu. Yd.	Class 2, 23,319 Cu. Yd.	Class 3, 39,045 Cu. Yd.
Interest on investment	0.81	1.21	2.25
Preparatory expense	1.33	1.99	3.73
Plant depreciation	3.63	5.41	10.12
Executive	0.89	1.24	3.09
Labor	5.98	7.85	21.03
Electric power	0.73	1.03	1.82
Supplies	1.13	1.67	6.72
Miscellaneous	0.16	0.15	0.29
Total	14.66	20.55	49.05

The general contractors are represented by Roderick McClure, superintendent, and the work has been under the immediate supervision of C. L. Bailey, A. F. Ross and V. W. Russell, resident engineers for the United States Reclamation Service. A. H. Ayers was construction engineer on about 75 per cent of the work, under R. M. Snell and Charles P. Williams, project managers for the Reclamation Service.

TABLE II—EXCAVATION COSTS IN CENTS PER YARD WITH CLASS 20 ELECTRIC DRAG LINE VALUED AT $20,957.13

Item	Class 1, 410,747 Cu. Yd.	Class 2, 4,180 Cu. Yd.	Class 3, 9,546 Cu. Yd.
Interest on investment	0.44	0.76	1.61
Preparatory expense	1.12	1.20	2.52
Plant depreciation	1.86	3.22	6.79
Executive	0.71	1.31	3.14
Labor	3.70	8.22	15.77
Electric power	0.78	1.78	2.80
Supplies	1.29	1.53	7.50
Total	9.90	18.02	40.13

MOTOR-OPERATED DRAG EXCAVATORS AT WORK ON SUN RIVER PROJECT OF UNITED STATES RECLAMATION SERVICE

Standby Battery for A. C. Distribution Service

Use of a Storage Battery in Suburban Substation to Protect Against Interruptions in Service —Ways to Maintain Normal Frequency and Voltage During Emergency Discharge

BY J. LESTER WOODBRIDGE
Chief Engineer Electric Storage Battery Company

AN interesting application of a standby storage battery to supplement alternating-current distribution service in a growing suburban district has been worked out by the Edison Electric Illuminating Company of Boston for its Newton (Mass.) substation. This substation is fed from the L Street power house of the Boston Edison company, and receives energy at 13,800 volts, three-phase, sixty cycles, over duplicate transmission lines, the transmission distance being 12 miles. Several high-tension tie lines also extend from this substation to other substations supplying adjoining districts. The substation supplies three classes of service, namely, (1) the local alternating-current commercial load of lighting and power, which is supplied to the distribution feeders at 2300/4000 volts, four-wire, three-phase; (2) direct-current series arc lights for street lighting, and (3) 575-volt direct current for operating the suburban electric railway in the district.

This substation was chosen for the first installation of this character partly because of the importance of the district served and partly because the existing apparatus in the substation was adapted for the purpose with but little change. The original arrangement of the apparatus is shown in Fig. 2 in full lines, while the apparatus added in connection with the battery installation is shown in dotted lines. The diagram is conventional and shows only one phase of the three-phase circuits and one side of the direct-current railway circuit. Duplicate high-tension busbars were provided, and duplicate oil switches for each incoming and outgoing circuit permit each circuit to be connected at will to either set of busbars. Step-down transformers furnish the 2300/4000-volt current for the local commercial load, constant-current "tub" transformers with mercury-arc rectifiers are used for the street lighting, and three 500-kw. motor-generator sets furnish the 575-volt direct current to the railway bus. Each of these units consists of a 13,800-volt synchronous motor directly connected to a 575-volt interpole direct-current generator.

PROBLEMS INVOLVED AT SUBSTATION

The problem presented to the storage-battery engineers was to install a battery to float on the railway bus, but so arranged as to provide a reserve source of power for the local alternating-current distribution circuits in case of any interruption in the power supply from L Street by feeding its energy through the motor-generator sets into the alternating-current circuit. It was necessary to arrange this apparatus so that in case of trouble the battery would take up the local alternating-current load without interruption, but would not feed into the entire high-tension distribution system through the 13,800-volt feeders and tie lines. It was necessary that the battery should take up the local load automatically, and without even the briefest interruption, and it was also important to maintain the frequency and voltage on the local distribution circuit as nearly normal as possible without attention on the part of the operators.

In order to accomplish these results, it was decided to use one of the duplicate alternating-current busbars for interconnecting all of the incoming high-tension feeders and outgoing tie lines, while to the other set of busbars would be connected all of the local distribution circuits, including the motor generators which supply the railway load. It will be noted that one of the high-tension busbars is divided into two sections, and this one was chosen for connection to the incoming high-tension feeders and tie lines. Two new oil switches, *B* and *C* in Fig. 2, were installed for connecting the distribution busbars to the busbars connected to the high-tension feeders. Normally, therefore, the entire current supply from the L Street power house is received on one set of busbars and transmitted through either or both of

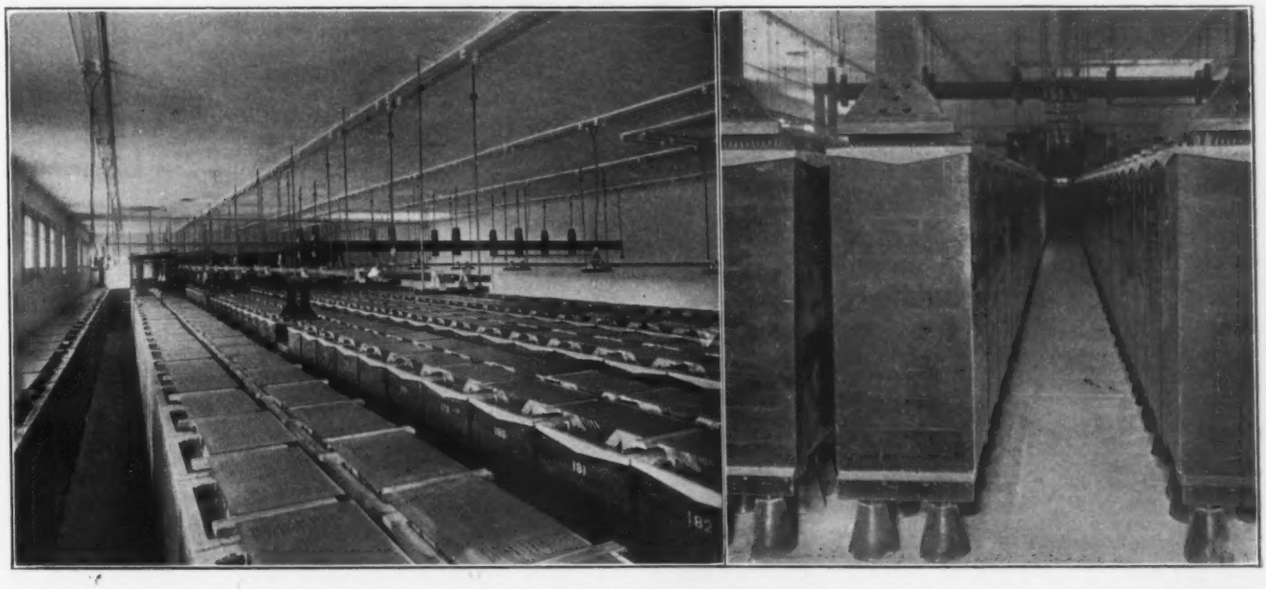


FIG. 1—INTERIOR OF BATTERY ROOM AT NEWTON (MASS.) SUBSTATION, WITH ARRANGEMENT OF CELLS AND CONNECTIONS TO BUSES SHOWN AT RIGHT

the oil switches *B* and *C* to the other set for local distribution. The opening of the two oil switches *B* and *C* will, therefore, completely separate the high-tension distribution system from the local supply circuits, including the railway circuit.

An "Exide" storage battery of 344 cells, having a capacity of 2250 amp. for one hour or 4650 amp. for

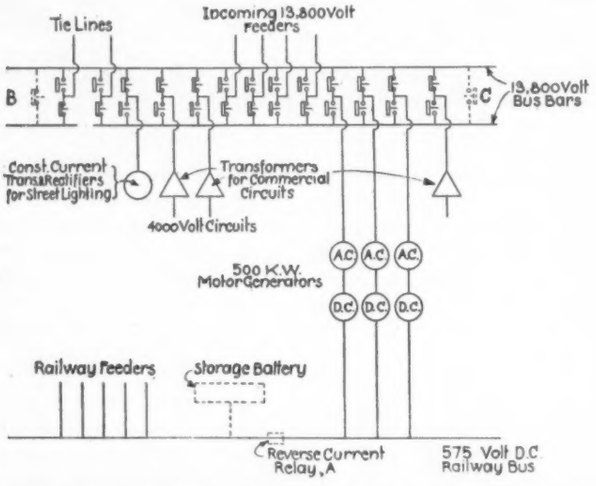


FIG. 2—ARRANGEMENT OF APPARATUS AND CIRCUITS IN NEWTON (MASS.) SUBSTATION. DOTTED LINES INDICATE APPARATUS ADDED WITH STORAGE BATTERY

twenty minutes, designed to float across the 575-volt railway bus, has been installed. This battery is connected to the railway bus between the terminals of the motor-generator sets and the outgoing railway feeders, and a reverse-current relay *A* is installed in the direct-current circuit between the battery and the motor-generator sets. Upon reversal of current between the battery and the generators of sufficient magnitude, due to any trouble on the high-tension circuits, this relay closes a contact which trips the two oil switches *B* and *C*, thus opening up the connection between the high-tension feeders and the local distribution circuits, leaving the battery connected to the latter through the motor-generator sets.

After this general arrangement of apparatus had been decided upon, it remained to provide for maintaining normal frequency and voltage on the alternating-current circuit during an emergency discharge from the battery. The local alternating-current distribution feeders are

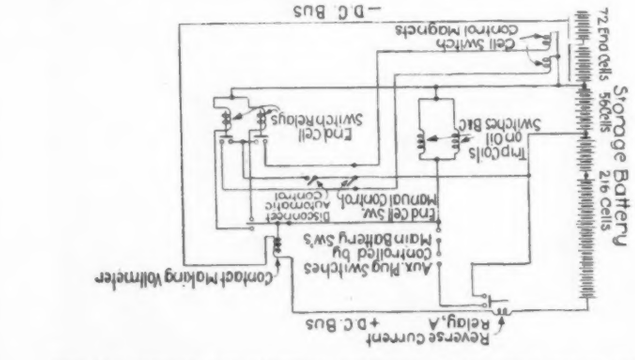


FIG. 3—AUTOMATIC-CONTROL CIRCUITS AT NEWTON SUBSTATION

provided with feeder regulators of the induction type, automatically operated by contact-making voltmeters, and these are relied upon to control the voltage of the distribution circuits. To maintain normal frequency was a more serious problem, the frequency depending upon the voltage of the battery and the characteristics of the motor-generator sets when running inverted.

METHOD OF OBTAINING CONSTANT VOLTAGE DURING BATTERY DISCHARGE

In order to insure constant voltage during an emergency discharge the battery is provided with motor-operated end-cell switches automatically controlled by a contact-making voltmeter connected across the battery terminals. This contact-making voltmeter closes, selectively, the exciting circuits of two relays arranged to operate the end-cell switches, one for either direction of travel, so that when the direct-current bus voltage is high cells will be cut out, and when the voltage is low cells will be added until normal voltage is restored. The exciting circuit of these two relays is, however, normally open, but is closed by the operation of the reverse-current relay *A* at the same time that the latter trips the oil switches *B* and *C*. Fig. 3 shows the arrangement of these control circuits. There are seventy-two cells of the battery connected as end cells, three cells between adjacent points of the cell switches, and in order to avoid the use of an end-cell switch with twenty-five points, two cell switches, each provided with thirteen points, were installed in tandem connected as shown in Fig. 6.

Having thus provided for the maintenance of constant voltage during an emergency discharge, the only remaining point to be determined was the characteristic

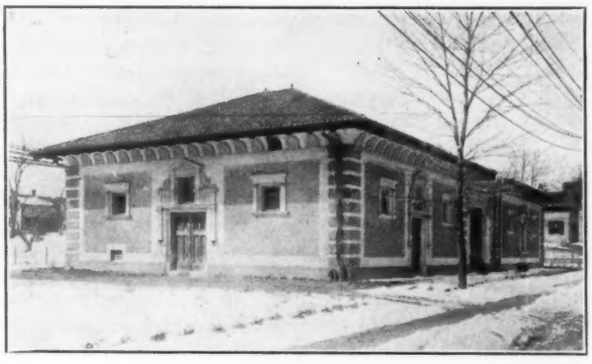


FIG. 4—NEWTON (MASS.) SUBSTATION OF EDISON ELECTRIC ILLUMINATING COMPANY

of the motor-generator sets when running inverted. The direct-current generators of these machines were designed to give practically constant voltage from no load to full load, with a decidedly drooping characteristic on overloads, thus protecting the machines by relieving them of a part of any excessive load when the substation is operating in parallel with adjacent substations. This characteristic was secured by so designing the machine that a distortion of the field flux due to armature reaction on overload would produce saturation in the trailing pole tip and in the teeth under this pole tip, thus reducing the total magnetic flux and the resulting voltage. It was found that this design gave quite undesirable characteristics to the machines when operated inverted. Two of these machines when thus operated in parallel would become unstable at less than half load, even when running as shunt machines with the series field entirely cut out, and the slightest unbalance would cause one machine to take all of the load, and reverse the other machine until the circuit-breakers would open. The reason for this is evident from an inspection of the speed-load characteristic as shown in Fig. 7, from which it will be seen that for loads exceeding about 100 kw. the speed increases at a continually increasing rate with increase of load. Obviously, two such machines could not operate with stability when connected in parallel at both ends, since the slightest change tending to throw additional load on one of them would cause it to speed up, and the slightest increase in speed

would cause it to take additional load, the effect becoming rapidly cumulative.

CHANGES IN DESIGN OF MOTOR-GENERATOR POLE PIECES

A study of the design of the machines showed that this result was due to the same effects of armature reaction and saturation which produced the drooping characteristic on overload when operating direct. To overcome this difficulty, the pole pieces of the machine were re-designed by introducing a step in the middle of the pole face to produce a sudden change in the length of the air-gap, as illustrated in Fig. 8. The length of air-gap was thus reduced on the leading side and lengthened on the trailing side. At no load and normal excitation the armature teeth and pole tips on the leading side would thus become saturated owing to the distortion of the field flux on the side of the short air-gap. The effect of armature reaction when the machine is operating direct is to restore a more uniform distribution of field flux by shifting the flux toward the trailing pole tip and weakening the field under the leading tip. As this continues, the effects of saturation under the leading tip disappear, and the weakening effect of armature reaction on the field strength becomes more pronounced, thus maintaining the original drooping characteristic on overloads. When running inverted, however, the effect of armature reaction is reversed, tending still further to strengthen the field under the leading tip and still further to weaken it under the trailing tip. The new design was such that the effect of saturation under the leading tip was about equal to the effect of the long air-gap under the trailing tip, and the resulting effect of armature reaction on the total flux was practically negligible. These new pole pieces were applied first to one of the machines for test and, this proving satisfactory, the other two machines were thus equipped. The resulting speed-load characteristic when running inverted was practically a straight line for all loads.

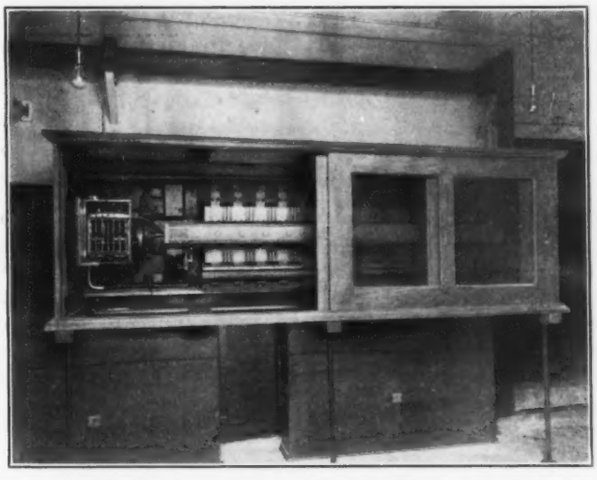


FIG. 5—THE THIRTEEN-POINT END-CELL SWITCH FOR NEWTON (MASS.) SUBSTATION BATTERY INSTALLATION

In order to secure still further stability, one turn of series field was added inside of the equalizer connection, connected to oppose the original series field, so as to act cumulatively when the machine is running inverted. The effect of this inside series field on the normal voltage characteristic of the machine was counterbalanced by removing the shunt from the outside series field, and a final adjustment was made by partially shunting the inside series field. As a result of these changes, the machines continue to operate as before when running direct, while the effect of suddenly inverting the machines when running in parallel is to divide the load equally between them with no tendency to instability.

OPERATION OF BATTERY IN CASE OF TROUBLE

During normal operation, therefore, the battery is floating directly across the railway busbars, which are maintained at a substantially constant voltage, so that the battery is doing no work. In case of any trouble on the high-tension distribution system of sufficient magnitude to cause the battery to take up all of the railway load, and actually feed back through the motor-generator sets into the alternating-current circuit, the reverse-current relay *A* will act, closing the tripping circuits of the oil switches *B* and *C*, thus opening these switches and clearing the local distribution circuit from the high-tension feeders, leaving the battery as the only source of energy to supply the local load. At the same time the relay *A* closes the exciting circuits of the end-cell switch-control relays, and the drop in battery voltage due to its discharge is immediately restored by the automatic operation of the end-cell switches.

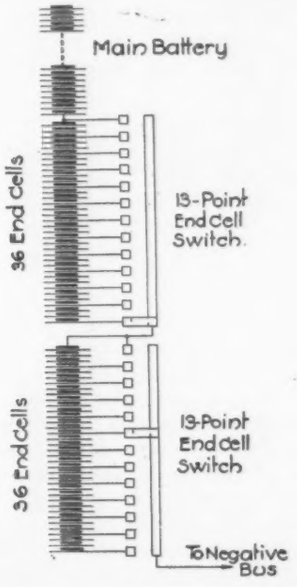


FIG. 6—CONNECTIONS OF TANDEM END-CELL SWITCHES

When normal conditions are restored on the high-tension circuits, the motor-generator sets may be synchronized with the high-tension busbars by means of a field rheostat, shown in Fig. 9, which serves to control the fields of all of the motor-generators simultaneously. During normal operation the resistance in this syn-

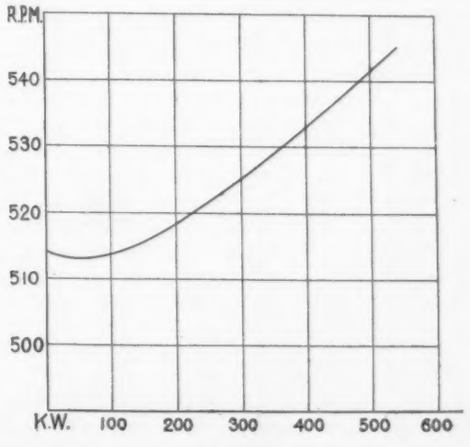


FIG. 7—ORIGINAL SPEED-LOAD CHARACTERISTIC OF SUBSTATION MOTOR-GENERATORS WHEN OPERATING INVERTED WITHOUT SERIES FIELD

chronizing rheostat is entirely cut out so that it has no effect on the individual field control of the machines. This rheostat, therefore, serves to increase the speed of the machines by cutting resistance into the field circuits. Should it happen that the speed is a little higher than the bus frequency when attempting to synchronize, the speed may be reduced by cutting out end cells of the battery, for which manual control is provided in addition to the automatic control by the contact-making voltmeter.

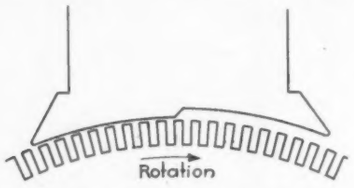


FIG. 8—REDESIGNED POLE SHOE OF MOTOR GENERATOR AT DIRECT-CURRENT END

Instead of providing a booster for charging the battery in one series, which would have involved a considerable additional investment and abnormally high voltage, it was decided to divide the battery into two halves and charge them in parallel from one of the motor-generator sets whose voltage can be reduced for this purpose. Each of the motor-generators is provided with a double-throw switch, permitting it to be thrown over on a charging bus for this purpose, while switches are also provided in the battery circuits for disconnecting the battery from the railway bus and connecting it in two halves in parallel to the charging bus, as shown in Fig. 9.

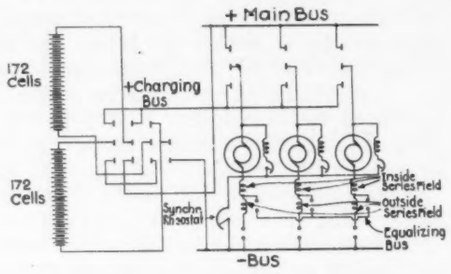


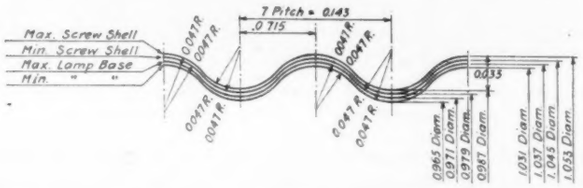
FIG. 9—MAIN D.C. CIRCUITS, INCLUDING BATTERY-CHARGING CONNECTIONS, ALSO D.C. FIELD-CONTROL CIRCUITS

The details of this installation were worked out by the engineering departments of the Electric Storage Battery Company and the Edison Electric Illuminating Company of Boston. The re-design of the pole pieces of the motor-generator sets to give the proper characteristics when operated inverted as described was done by the engineers of the former company.

Standardization of Threads of Sockets and Lamp Bases

Recommendations of American Society of Mechanical Engineers on Design of Screw-Shell Lamp-Socket Threads for Lamp Bases, Fuse Plugs, Attachment Plugs and the Like

The committee on standardization of special threads of the American Society of Mechanical Engineers has recommended that the dimensions of the threads of the screw shells of electric sockets and lamp bases be standardized as shown in the accompanying table. Only minor changes from the generally recognized standards for these threads have been made, and twenty-seven out of thirty-eight of the largest manufacturers approved the recommendations, no objections to the recommended standards having been received. An investigation of the German standard for medium-size shells showed that, although the same number of threads per inch are used as in the American standard, the depth of thread is greater and different diameter dimensions are in use. It was, therefore, deemed unwise to consider this standard. The dimensions given for lamp-base screw shells in the accompanying table apply to the male threads used on lamp bases, fuse plugs, attachment plugs, etc., and the dimensions given for socket screw shells apply to female threads such as used on lamp sockets, receptacles and similar devices. For male threads two-threaded ring gages should be used in each case to govern the diameter of the bottom of the thread outside and the form of the thread, and two plain ring gages should be used to govern the diameter of the top of the thread outside. For female threads two-threaded plug gages should be used in each case to govern the diameter of the top of the thread inside and the form of the thread, and two plain plug gages should be used to govern the diameter of the bottom of the thread inside. The gages in each case should be marked "Go" and "Not go" respectively, according to the dimensions given in the table.



DESIGN OF THREADS FOR SCREW-SHELL LAMP SOCKETS AND BASES

DIAMETER DIMENSIONS OF STANDARD THREADS FOR LAMP BASES AND RECEPTACLES

	Miniature		Candelabra		Medium		Mogul	
	Socket Screw Shell	Lamp-Base Screw Shell	Socket Screw Shell	Lamp-Base Screw Shell	Socket Screw Shell	Lamp-Base Screw Shell	Socket Screw Shell	Lamp-Base Screw Shell
"Go" gage, top of thread	0.3775 in.	0.3750 in.	0.470 in.	0.465 in.	1.045 in.	1.037 in.	1.565 in.	1.555 in.
"Not go" gage, top of thread	0.3835 in.	0.3700 in.	0.476 in.	0.460 in.	1.053 in.	1.031 in.	1.577 in.	1.545 in.
"Go" gage, bottom of thread	0.3375 in.	0.3350 in.	0.420 in.	0.415 in.	0.979 in.	0.971 in.	1.465 in.	1.455 in.
"Not go" gage, bottom of thread	0.3435 in.	0.3300 in.	0.426 in.	0.410 in.	0.987 in.	0.965 in.	1.477 in.	1.445 in.
Threads per inch	14	14	10	10	7	7	4	4
Depth of thread	0.020 in.	0.020 in.	0.025 in.	0.025 in.	0.033 in.	0.033 in.	0.050 in.	0.050 in.

A SCENE IN THE ELECTRICALLY OPERATED KERN RIVER OIL-WELL DISTRICT—"BUTTERFLY" EQUALIZER GUIDE

Electric Operation of Oil Properties

Pumping Wells and Transportation Pipe Lines from a Central Power Station, Effecting Continuous Operation and Reduction in Attendance

BY L. R. W. ALLISON

THE Kern River oil fields, about 5 miles from Bakersfield, are among the most productive oil properties in California. In the district are about 1400 active wells, producing an average of 14 barrels of oil per well each day, or an aggregate monthly output approximating 600,000 barrels. The oil from this locality is of high specific gravity, varying from 10.4 deg. to 17.0 deg. Baumé, with productive depths ranging from 300 ft. to 600 ft.

In the Kern River field electric operation, with energy furnished from a central generating station, is fast superseding the isolated gas and steam-engine plants formerly employed, affording greater economy in operating facilities, the simplification of general methods, and increased efficiency of production. Electric drive for oil-well pumping, it may be pointed out, brings about practically automatic operation from well to tank car. Labor and inspection costs are reduced to a minimum, and continuity of the service is greatly enhanced. In one installation on the Central Point Division properties of the Associated Oil Company in the Kern River field a central electric power station operates sixteen oil wells and a pipe line.

The standard Fulton pumping jack or power head, which operates upon the principle of an eccentric, is driven by a 35-hp. constant-speed motor, taking electric energy from the system of the San Joaquin Light & Power Company. The motor, which is installed at one end of the building, is belt-connected to the jack, mounted at the other end, through the means of an intermediate floor-stand countershaft provided with a friction clutch.

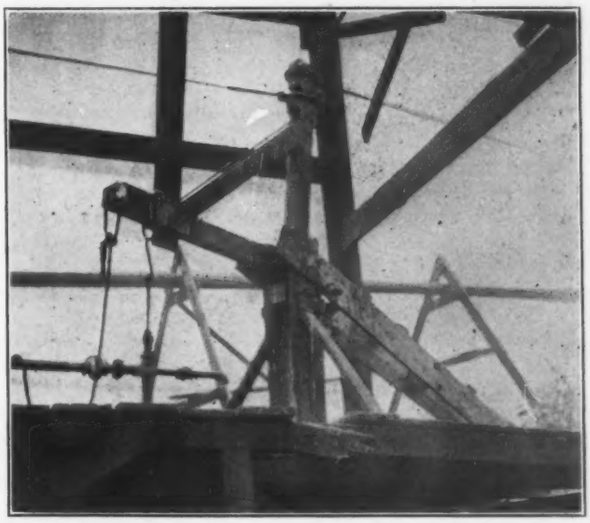
The pumping jack is operated by gears on a vertical countershaft and by two eccentrics on top of the shaft, which extends through the roof of the station. Aerial cables or jack lines are connected and strung from these eccentric yokes to the different oil wells, each line in turn being attached to a rocker beam or arm of the pump at the well head.

While simplicity of operation is obtained when the jack is installed in the middle of a group of wells, this is not always feasible owing to the continual opening up of new properties and the abandonment of old wells. Accordingly, the cables reaching to the wells vary considerably in length, ranging from 150 ft. to 1000 ft. and more, a condition which necessitates a balancing of the load upon the two eccentrics. This is effected by means of grooved circular-disk cable guides mounted on substantial wood poles, as pictured at the head of this column. These guides, termed "butterflies," are situated so as to divert the cables at the desired angle, equalizing the load in all directions. Similar connections with the pumping jack are also arranged for the pumps forcing the oil through the pipe lines. In this way there is accomplished the pumping and transportation of oil with one operation from the central jack.

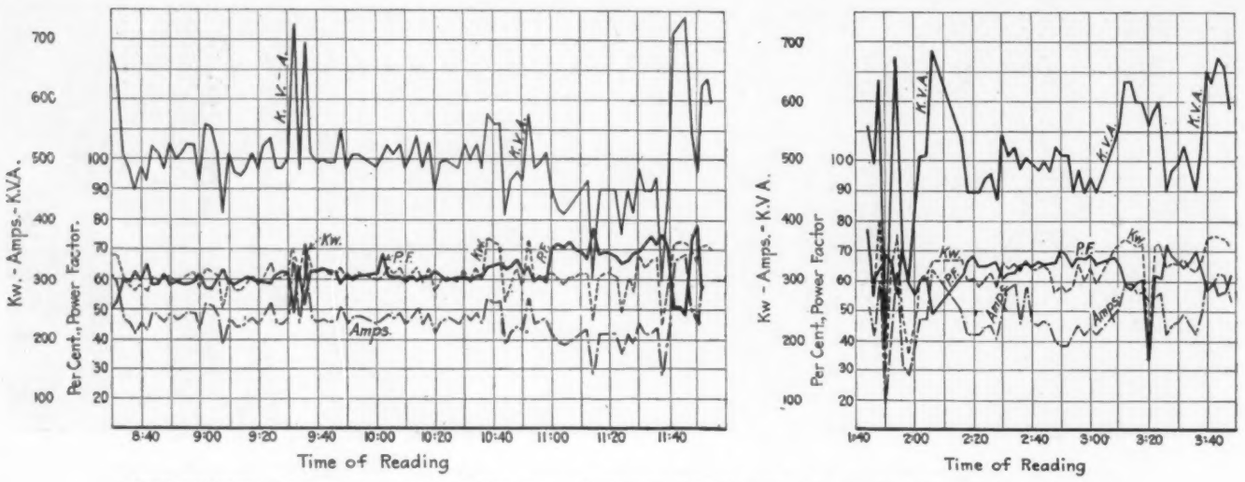
The central pumping station is equipped with a switchboard for motor control, but following the starting of the motor little further attention is required. An automatic gravity oiling system, with supply tank mounted on the wall, provides for lubricating the bearings of the motor drive and jack shaft, while the waste, drawn off into a container, is utilized for the lubrication of the eccentrics. The operation and supervision of this system is the work of one operator, eliminating the presence of oilers and other auxiliary station labor.

The pressure furnished by the settling-tank pump is sufficient to run the oil to the automatic gas furnace, where it is heated 200 deg. and on to a concrete storage reservoir with a capacity of about 14,000 barrels, from which final shipment is made. From this storage tank the oil is run by gravity flow into shipping tanks, tank cars or the like, being measured at the same time.

The installation described was made by Charles L. Easton, electrical superintendent of the Bakersfield district of the San Joaquin Light & Power Company, and W. M. Thurston, chief electrician for the oil company in the Kern River fields.



ROCKER ARM AT WELL HEAD OPERATED FROM CENTRAL MOTOR



PERFORMANCE CURVES FOR TRIAL RUNS OF A 1-TON ELECTRIC FURNACE SERVED BY DAYTON COMPANY

Operating Characteristics of Small Electric Furnace

Experience of Dayton Power & Light Company in Serving a Furnace That Calls for 600 Kva. and Returns $1,700 per Month

THE operating features of a small single-phase electric furnace for the manufacture of steel, connected to the system of the Dayton (Ohio) Power & Light Company, were outlined by J. C. Mathieu in a paper presented last week before the Ohio Electric Light Association.

The author pointed out the fact that the single-phase furnace in most cases when served by a central station requires an individual feeder directly from the generating station. This is called for because of the fact that furnaces smaller than 1 ton capacity are not strongly recommended in commercial practice, and that such a furnace takes about 600 kva. at rather low power-factors. Companies having a four-wire, three-phase distribution system can furnish the necessary single-phase service by a suitable arrangement of transformers. Energy at any voltage can be furnished, as transformers form a part of the furnace equipment.

A 1-TON ELECTRIC FURNACE IN A DAYTON (OHIO) FOUNDRY

The variations in current in a small electric furnace arc due to changes in condition in the furnace are shown by the accompanying curves, the disturbances being greater at the beginning than at the end of the heat. This is caused by the cold scrap melting down and changing the arcing distance between the top electrode and the charge. As the heat continues, the surface of the charge becomes more even, and as it reaches a molten state an even curve can be maintained with proper furnace operation. The disturbances that occur during the heat are usually due to the manner in which the flux is thrown into the furnace. If thrown in carelessly, the arc will be broken and the electrodes must be brought together, giving a decided drop in the curve.

The input to the 1-ton furnace for which operating data are given is approximately 350 kw., and, with the exception of the disturbances outlined above, the load is fairly constant. It requires about two hours per heat, and with ten heats per twenty-four hours the energy consumption is approximately 170,000 kw.-hr. per month. The rate for this load is approximately 1 cent per kilowatt-hour under a guaranteed load-factor of 50 per cent. The average power-factor for this installation is slightly over 55 per cent. This apparently low power-factor is due to the reactance that has been placed in the circuit to hold down the flow of current during such times as the electrodes are in direct contact. A smaller reactance would improve the power-factor but at the same time increase the effect of disturbances at the generating station.

From the tests made by the Dayton company the average input to this furnace per ton of steel has been approximately 660 kw.-hr. after the furnace has been brought up to heat. The single-phase furnace has been operated when the station load was 6000 kw. with an available generating rating of 9000 kw., and no severe disturbances have been suffered. The extreme fluctuations occur when the furnace goes on and off suddenly, requiring the station exciters to operate through a wide voltage range. The load as handled by a direct feeder and transformer is considered fairly satisfactory from an operating standpoint; however, it was suggested in case smaller stations encountered a large single-phase load that a phase converter be used.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Construction and Operation of a Small Steam Plant

Conditions Governing Nature of Generating and Distribution System to Furnish Energy to Small Communities and to Some Twenty-five Industrial Plants on Vashon Island

BY GLENVILLE A. COLLINS
Consulting Engineer, Seattle, Wash.

VASHON ISLAND is in Puget Sound between Seattle and Tacoma, Wash. It is 12 miles long and 4 miles wide, with its northern extremity 8 miles from the center of Seattle's business district and its southern end about 3 miles from Tacoma's city hall. There are 23,000 acres of rich soil on this island available for cultivation, of which about 3500 are now used as orchards and berry gardens. The climate of the island is somewhat warmer than that of Seattle, owing to its sheltered position, and this fact has been taken advantage of by many horticulturists in nurseries and in greenhouses. There is one greenhouse at Vashon that has 7 acres under glass, and this, with several other plants, covering a total of about 20 acres of houses, requires artificial heating for the raising of cucumbers, tomatoes, lettuce, flowers, etc.

There are a number of small towns and summer resorts on the island with a population of from 200 to 700 people, which together represent a population of about 5000. These various towns have no water systems other than local wells. In connection with these pumping by gasoline engines has been the practice. There are two canneries on the island, three small shipbuilding plants, five sawmills, seven shingle mills and one planing mill, besides a creamery, slaughter houses, bone factory, cabinet works and an ice-cream factory. The opportunities for the use of electrical energy for lighting and power purposes are apparent, especially in view of the fact that the nearest point to the mainland where energy is available would require about 3 miles of submerged high-tension cable laid at a maximum depth of over 1500 ft.

NATURE OF DISTRIBUTION SYSTEM FOR THE ISLAND

An analysis of the possible light and power users showed that they were situated about 400 ft. apart, requiring long distribution lines and arrangements to generate and distribute energy at a low cost. The distribution problem was worked out by using 35-ft. and 40-ft. live-cut cedar poles with minimum tops of 7 in. set about 170 ft. apart and employing 5-ft. fir crossarms with locust pins and galvanized hardware. Thomas 6600-volt insulators are used.

Owing to the fact that nearly all of the distribution lines parallel telephone lines and invariably run over them in close proximity, it was deemed advisable to use weatherproof wire for the transmission lines. For all

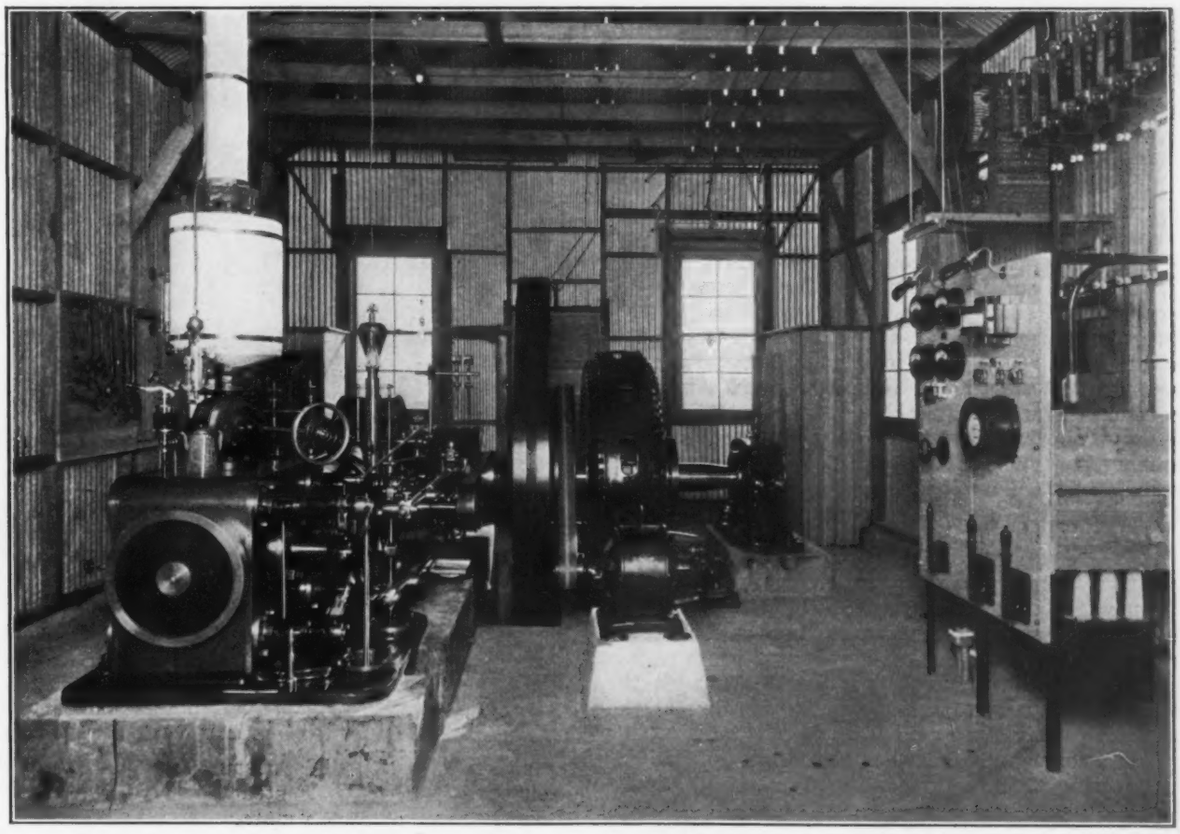


FIG. 1—A 100-KVA. GENERATOR DRIVEN BY 140-HP. CORLISS ENGINE, WITH ITS SWITCHBOARD, IN VASHON STATION

of these lines, therefore, No. 6 double-braid copper on both primary and secondary circuits was used. The primary circuits are 2300 volts, three-phase, sixty-cycle, and the secondary circuits two-wire, 125 volts. At first the cost of transformers seemed prohibitive, but it was finally decided to use General Electric type H units of large size at several distant points, rather than

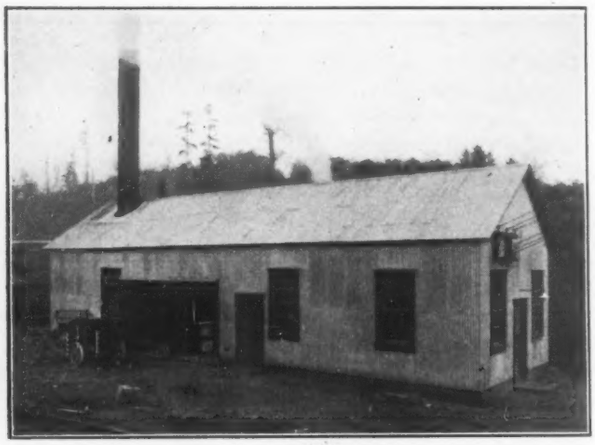


FIG. 2—CORRUGATED GALVANIZED-IRON STRUCTURE, 20 FT. BY 60 FT., HOUSING STATION EQUIPMENT

small transformers of 1 kw. and 2 kw. at the customers' service connection. This has worked out satisfactorily owing to the fact that the generating voltage of 2400 permits a voltage of not less than 112 at the ends of the distribution lines. There are 18 miles of this type of line, none of which is over 4½ miles from the generating plant.

The cost of constructing this distribution system was very reasonable. The 40-ft. poles were contracted for and erected complete, including the digging of a hole 5 ft. deep, for $4 each, and the 35-ft. poles for $3.50 each. The company furnished the cross-arms and hardware.

METHOD OF ERECTING POLES

In setting the poles an A-frame 25 ft. high mounted on a wagon frame was effectively used. After the poles had been distributed and the holes dug, it was found possible for two men and a team to erect thirty poles per day in the following way: The A-frame was backed into position at the pole hole, and a block and tackle was fastened to the pole well above its center. The fall line from the block and tackle fastened to the pole and the top of the A-frame was then passed through another block at the base of the A-frame. The team used to haul the wagon was hitched to this fall line and the pole raised clear of the ground for lowering into position. Two men were required for this operation. As soon as the pole was lowered into its hole the team and A-frame were moved to the next pole. A second crew of two men followed and lined up the poles, filled and tamped the holes, and guyed those poles where such construction was necessary.

OPERATING FEATURES CONSIDERED IN STATION DESIGN

The power station is situated close to tidewater by a small brook, where fresh water is available, and near a large greenhouse. An interesting feature of this situation is that a contract has been made with the greenhouse company to use steam for heating at the same price it previously paid for coal plus labor. This greenhouse company had been using 250 tons of coal per season, costing $2.50 per ton, and fired in a small tubular boiler. California crude oil is used under the boilers of the plant. This costs 82 cents per barrel, delivered in 500-barrel lots at the plant. The oil is purchased under contract at this price for a term of three years. The fuel oil is stored in a large tank 100 ft. from the station and fed by gravity or pump to an oil set consisting of one Worthington duplex oil pump mounted over an oil heater and fitted with an oil overflow-return pipe and strainers. The steam pump exhaust is used in the oil heater. The oil line contains a meter, a water extractor and a Crombie atomizer and burner. Steam for atomization is secured from the main steam line through a 1-in. pipe and passed through the fire box for superheating, thus supplying oil to the fire box at high temperature, practically at the flash point.

In designing the station it was estimated that 100 kva. of equipment would be sufficient to serve the demands on the system for the first two years on the basis of being able to handle a 200-kw. connected load of a well-diversified character. Water-tube boilers and directly connected Corliss engine generating sets with the usual auxiliaries were decided upon. The plant equipment as now operated consists of one 125-hp. Murray water-tube boiler, oil-fired, and one 140-hp. Murray Corliss engine directly connected to a 100-kva. Westinghouse 2400-volt, three-phase, sixty-cycle alternator, operating at 150 r.p.m., with a steam pressure of 150 lb.

FEATURES OF STATION AND ITS EQUIPMENT

The equipment of the plant is housed in a galvanized corrugated building, 20 ft. by 60 ft., built on concrete foundations and provided with a concrete floor. Owing to the fact that the ground was rather spongy, the boiler foundation slab was heavily reinforced so that an unequal settling would not crack the brickwork but move as a body with its load. This slab was built 20 ft. by 10 ft. by 20 in. thick, and under load of the boiler and stack has settled only ½ in. The engine foundation was made in mass, 8 ft. deep, resting on sand and gravel over blue clay. All concrete was made from sand and gravel shoveled from the beach without screening.

The exhaust of the engine passes through a Murray

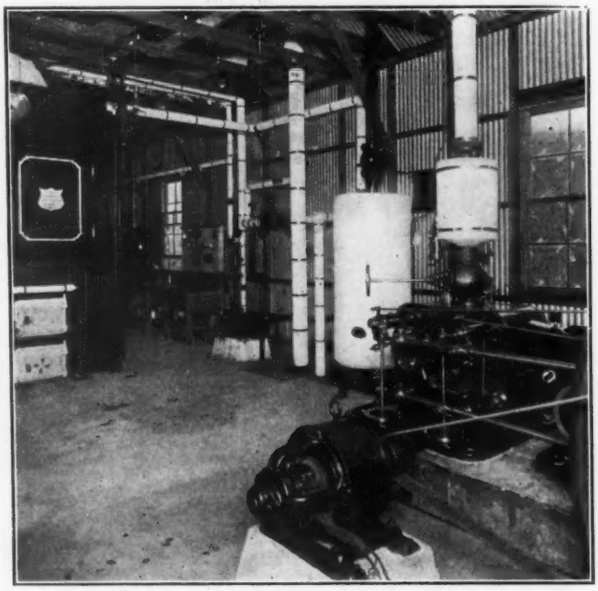


FIG. 3—BOILER-ROOM END OF STATION, SHOWING CLOSED HEATER PUMP AND PIPING WITH ENGINE IN FOREGROUND

30-in. closed heater. The exhaust pipe is equipped with a Davis back-pressure valve so that the exhaust pressure can be set to balance the heating load at the station greenhouse. The exhaust steam line is provided with an oil separator and an Empire water trap. Owing to the fact that the station is operated only until midnight, an auxiliary high-pressure line is brought from the

boiler and passed through a Squires pressure-reducing valve, so that steam is furnished the greenhouse at such times as the engine is not operating or the exhaust steam is insufficient.

There is a 5-hp. vertical tubular boiler for use in starting the pumps or for cleaning. The feed water is pumped by a Blake-Knowles boiler-feed pump from a well and discharged through the heater to the boiler, so that the pump handles only cold or luke-warm water. The feed-water temperature averages 223 deg. Fahr. when using the exhaust heating system and about 210 deg. when operated without it. A part of the return water from the greenhouses is used by the company in mixing hot feed for a herd of hogs, which seems to justify the claims of this herd-raiser for warm feeding and, besides, makes good use of the by-product.

It is planned to install a 6-ton ice machine to operate during the summer season when no heating is required. There is no ice available on the island, although there is considerable demand for it.

OPERATING COSTS

The steam consumption of the Corliss engine is approximately 24.8 lb. per i.hp.-hr. at full load, so that calculations seem to show that energy at the switchboard costs approximately 0.82 cent per kw.-hr. The rate charged customers for lighting service is 12 cents per kilowatt-hour for the first 30 kw.-hr. and 10 cents for each kilowatt-hour in addition. The rate for power is 8 cents per kilowatt-hour for the first 60 kw.-hr. and 6 cents for all in addition.

Two operators are required at the plant during its nineteen hours of service per day in addition to a superintendent who acts in the capacity of a bookkeeper, making out and collecting bills and taking care of all line work. Three men are thus required to handle the entire system from an operating standpoint. The cost of distributing energy is about 2.4 cents per kilowatt-hour in addition to the 0.82 cent per kilowatt-hour as cost of generating the energy at the switchboard.

The plant and entire project was designed by the writer and constructed under his supervision.

Changing Connections of a Motor Starter to Improve Starting Torque

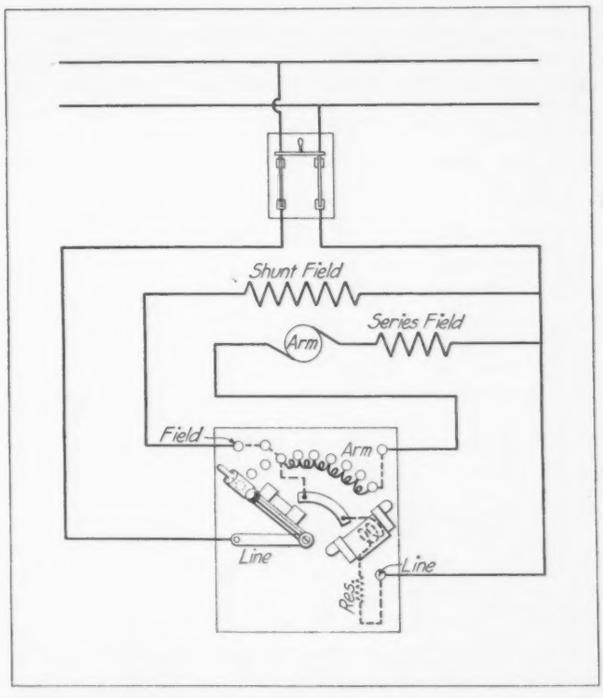
BY LEONARD KEBLER

President Ward Leonard Electric Company

The writer is interested in the article entitled "How an Operator Secured a Better Starting Torque from a Shunt Motor," published on page 1317 of the Dec. 11 issue of the ELECTRICAL WORLD. If the motor is connected as shown in the diagram accompanying that article, there will be an inductive discharge at the knife switch every time it is opened when the starting arm is in the off position. This in itself should be enough to condemn the arrangement. The article further says: "This arrangement gives full field strength at the instant the main-line switch is closed and relieves arcing at the point *X* when starting the motor." The arcing at the point *X* as shown in the diagram is due to the armature current only, while connected in the standard way it would be that due to the armature current plus the field current. As the field current is usually about 3 per cent of the full-load armature current, the difference in arcing would not be noticeable. With standard connections the field is connected to the point marked *X*, and when the starting arm touches the first live contact, which is the point *X*, the field is placed directly across the line at the time the armature current is made. Just how the operator secures a better condition than this was not explained.

When the motor is connected in either of the two ways mentioned in the article, it would have exactly the same torque and exactly the same tendency to start on the first step of the resistance, because in either case the field would be connected directly across the line and the armature connected directly across the line in series with the resistance of the starter. The mere fact that the field was connected permanently in one case and only at the time when making the first contact in the other would have no bearing on the matter unless the field were of such a type that it took several seconds to reach full flux and the operator did not leave his resistance-controlling arm on the first button for this length of time.

Apparently the key to the situation lies in the fact that the operator considered he was improving the equipment by dispensing with the small contact marked *X*, since relief from arcing is mentioned. This small contact is connected directly to the first resistance contact and is put there solely for the purpose of standing the arcing so that the arcing will not roughen the first resistance contact and keep the lever from moving freely over the starting contacts.



A MOTOR STARTER THAT PROVIDES FULL FIELD STRENGTH DURING OPERATION AND PREVENTS INDUCTIVE ARCING WHEN MAIN CIRCUIT IS BROKEN

In order to keep full field strength constantly during the operation of a motor starter of this type, it is only necessary to place a small brass arc near the center post of the starter, as shown in the accompanying diagram. A contact on the starter arm touches this plate before the starter arm leaves the first live contact, when moved to start the motor. When the starter arm is moving to stop the motor, contact with the plate is broken before the starter arm breaks the contact on the first terminal. Thus the main motor circuit is broken with the field and the armature connected together in a local loop, and all inductive arcing is prevented.

This small plate is sometimes added on starting rheostats that have very high resistances, but as there is an additional cost of from 5 to 10 per cent for such an arrangement, its practical advantage is usually found to be less than the additional cost.

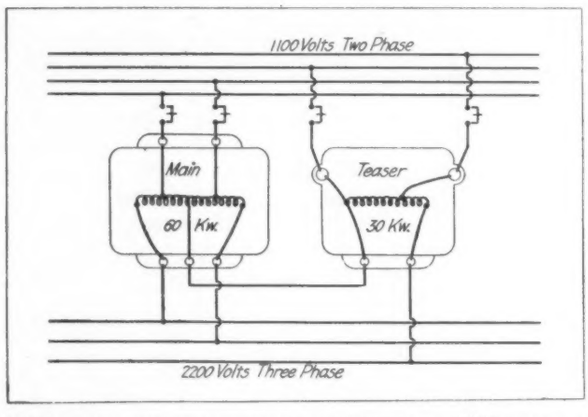
Sea-Water Corrosion of Copper-Zinc Alloys Suitable for Condenser Tubes

In the discussion on sea-water corrosion of metals at a recent meeting of the Faraday Society at London, England, W. E. Gibbs of Liverpool pointed out that the rate of corrosion of copper-zinc alloys diminishes as the zinc content increases, and reaches a minimum at the composition which corresponds to equal atomic concentration of zinc and copper. A further increase in the concentration of zinc leads to a gradual increase of the rate of corrosion until pure zinc is reached. Up to 50 deg. C. the initial rate of corrosion of 70/30 brass is greater at higher temperatures than at low. At the same time the rapidity with which the initial rate of corrosion falls off with time is greater the higher the temperature. At 60 deg. C., however, the initial rate of corrosion is smaller than at 15 deg. C. Hard-drawn 70/30 brass dissolves less rapidly than the annealed alloy, but undergoes dezincification more readily. This seems to explain the lower rate of corrosion of metal of high zinc content, such as Muntz metal and Admiralty metal, when used for surface condenser tubes where salt water is used for cooling.

How a Two-Phase-to-Three-Phase Transformation in a Station Was Made at Small Cost

In the power house of the Ames (Iowa) municipal electric-light plant an old reciprocating unit is used as a standby for a new Curtis turbine unit by means of a scheme which cost $442 less than arrangements to use standard methods would have done. Charles E. Warsaw, manager of the plant, had two old transformers in stock, a 60-kva. unit and a 30-kva. unit, which he sent to the makers with instructions to rearrange the windings and provide auto-transformer connections throughout. The ratio of transformation was small, so that a guaranteed rating for the two small units of 200 kva. was obtained. With a T-connection of the transformers and the 30-kva. unit used as the teaser, these two transformers were connected between the two-phase, 1100-volt and the three-phase, 2200-volt buses, as shown.

This arrangement made it possible to operate the old



CONNECTIONS FOR TRANSFORMING TWO-PHASE, 1100 VOLTS, TO THREE-PHASE, 2200 VOLTS

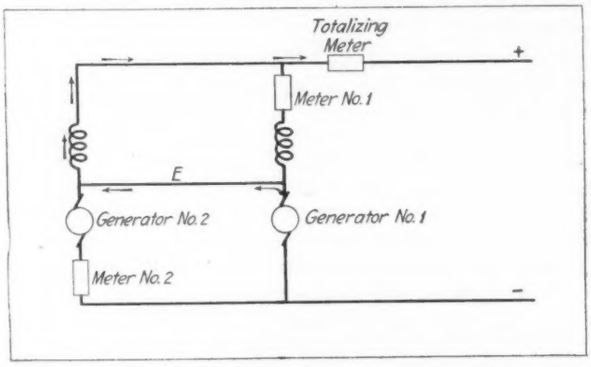
145-kva., two-phase, 1100-volt reciprocating unit as a standby for the single new 500-kva., three-phase, 2200-volt turbine unit.

The same end could have been accomplished by rewinding the generator or by buying two 100-kva. transformers and using a straight Scott transformation. The former plan was not entirely feasible, however, since the manufacturer estimated that the machine would be out of service between two and three weeks while the change was being made, and that it would cost an excessive amount, which was $558 more than that for the scheme used. The cost of the other possible plan, using the Scott transformation, was also excessive and would have been $442 more than that of the scheme used.

Importance of Proper Installation of Generator Meter Shunts

By WILLIAM R. DAVIS

A case recently came to the writer's attention illustrating the importance of proper installation of current shunts on direct-current generator circuits when two machines are operated in parallel. The accompany-



LOCATION OF GENERATOR METERS WHEN READINGS DID NOT CHECK WITH TOTALIZING METER

ing diagram shows how the shunts were installed when it was found that the sum of the readings of two recording wattmeters connected to the generators did not equal the reading of the meter connected to the main bus, which recorded the total output. The meters were checked and found to be correct. When only one generator was in operation, the reading of the meter connected to it checked with the total output, as recorded by the totalizing meter. As soon as the generators were paralleled, however, the sum of the readings of the two generator meters would be from 5 to 15 per cent less than that of the totalizing meter, growing with the load.

To correct the error the shunt on the larger generator was placed in the same side of the generator circuit as the one on the smaller machine. The readings of the two meters then checked with the reading of the totalizing meter. It was plain that some current from the larger machine was flowing through the equalizer, through the series field of the smaller machine, and then through the main bus, where it was recorded by the totalizing meter but not by the generator meters.

Weight to Specify When Purchasing Wet Coal

By W. F. SCHAPHORST

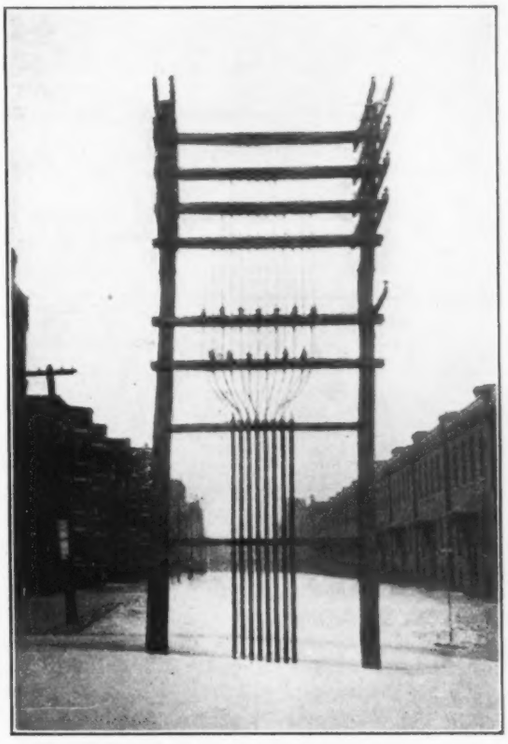
The writer agrees with R. I. Elkin in his claim that there is no gain in heat when burning watered coal as explained in the Jan. 8 issue of the ELECTRICAL WORLD, page 97. When wet coal is purchased, therefore, a greater weight per ton than 2000 lb. should be specified —about 2011 lb. This weight per ton is arrived at from the observation that 10 lb. of water will wet a ton of coal fairly well, although much depends upon the kind of coal. Bituminous coal in small chunks, and really dusty, will carry much more water per ton than

would larger chunks. The same is true for anthracite coal. It is always worth while, therefore, for the purchaser to correct for watering when buying coal in large quantities.

The extra pound to make up the 11 lb. is added because about 1 lb. of coal would be required to evaporate the 10 lb. of water into steam. Roughly, then, 2011 lb. of watered coal is equivalent to 2000 lb. of dry coal.

How Underground and Overhead Circuits at Holyoke, Mass., Are Connected

An effective means of transferring overhead circuits to underground conduits has been devised by J. L. Freelove, chief engineer of the Holyoke (Mass.) municipal electric-light plant, in a recent rearrangement of circuits in that city. Owing to a canal between the station and the portion of the city to be served, the feeders were carried on poles about 800 ft. to a structure such as shown in the accompanying illustration, consisting of two poles 14 ft. apart with four double cross-arms on each pole. These double cross-arms are connected by six pairs of connecting arms and two single arms, the latter supporting sections of 25-in. iron conduit which extend from about 14 ft. above ground to a manhole at the edge of the sidewalk.



STRUCTURE FOR CONNECTING UNDERGROUND CIRCUITS TO OVERHEAD LINES

Three arc, two three-phase power and five commercial feeders run to the left-hand pole in the illustration and are there dead-ended. The wires are tapped off to insulators on the connecting arms at the same levels, the lines on either end of the cross-arms being connected to the insulators of the cross-arm on that side, thus obviating the crossing of wires. From the lower rows of insulators the wires are carried to a double row of G. & W. pot-heads which surmount the nine parallel conduits on either side of the supporting arms. Thirteen of the eighteen conduits are occupied each by a single circuit, the other five being in reserve for future extensions.

Engineering Features of a New Illinois High-Pressure Steam Station

Work has been started on the new power station of the Public Service Company of Northern Illinois on the Desplaines River 1 mile south of Joliet, Ill. As mentioned in the ELECTRICAL WORLD of Oct. 15, 1915, this installation will embody the latest ideas in high-pressure steam generation. The three Babcock & Wilcox boilers to be installed will be of the cross-drum type with a heating surface of 10,000 sq. ft. and will produce steam at 350 lb. pressure with 225 deg. Fahr. superheat. Superimposed on each boiler there will be a Babcock & Wilcox all-steel economizer with 6700 sq. ft. of heating surface. Each boiler with its economizer will comprise a complete unit which will be incased in a steel shell to prevent air leakage. Two of these units will supply enough steam to operate one 12,000-kva. turbo-generator. The third boiler will be held in reserve.

Two Babcock & Wilcox chain-grate stokers placed side by side in a single furnace will serve each boiler. The stokers will each measure 8 ft. wide by 14.5 ft. long, giving a grate area of 232 sq. ft. per boiler. The ratio of grate area to heating surface will be 1 to 42.5. This is one of the highest ratios used by any power house in the Middle West. Induced draft will be supplied by motor-driven blowers. An individual self-supporting steel stack will be installed for each boiler. The only steam-driven auxiliaries in the plant will be the boiler-feed pumps, which are to be of the multi-stage, turbine-driven type. A bucket elevator will be used to convey the coal from the cars to overhead bunkers, and the ashes will be handled entirely by conveyors from the furnace until deposited in outgoing gondola cars. The fuel which is to be used will be screenings from the Illinois mines.

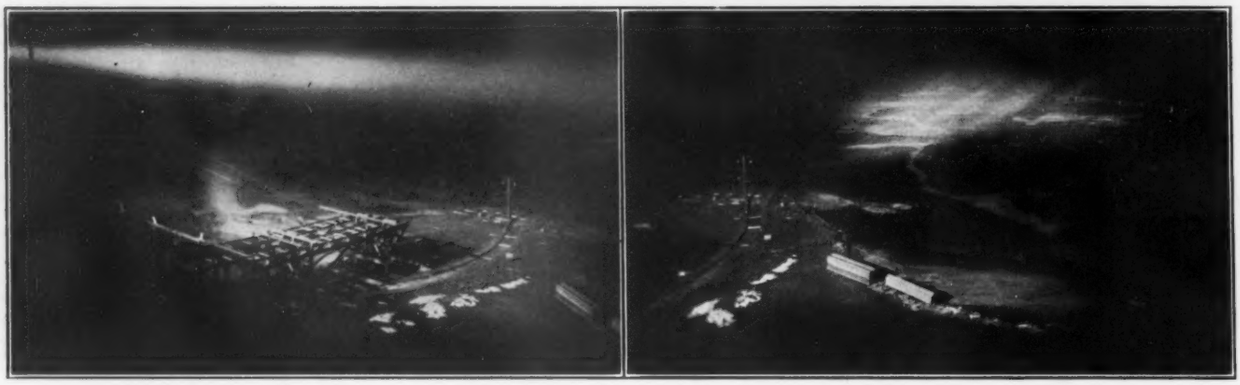
At present one turbine of the Curtis horizontal type with an exciter on the same shaft will be installed. It will be rated at 12,500 kva. or 10,000 kw. at 80 per cent power-factor, and will produce energy at 12,000 volts, three-phase, sixty cycles. The turbine is designed for a working pressure of 300 lb. In the steel and masonry building which will be erected space will be provided for a second future unit which will probably have a rating of 20,000 kw.

The Westinghouse surface condenser into which the turbine will exhaust will contain 20,000 sq. ft. of cooling surface and will be designed for a back pressure of 0.77 in. absolute. With the turbine operating at full load the condenser will take 18,000 gal. of circulating water a minute. The condenser auxiliaries, including the Leblanc air pump, are all to be motor-driven.

Most of the energy from the station will be stepped up to 33,000 volts and fed into the company's transmission loop, which reaches towns in the Fox River Valley and the Illinois River Valley, and extends as far south as Pontiac and Kankakee. Besides supplying energy for lighting and industrial power in this district, the company also sells energy for operating several street railways and interurban lines. When the new plant is placed in operation, as it is expected to be in about a year, it will augment the company's generator rating by just 12,500 kva., since operation of none of the company's other plants will be discontinued at that time.

The station is being designed by Sargent & Lundy, consulting engineers, Chicago, assisted by Von Holst & Fyfe, architects. It will be operated by the Public Service Company of Northern Illinois, of which Samuel Insull is president, F. J. Baker is vice-president in charge of operation and construction, G. H. Lukes general superintendent, and J. L. Hecht mechanical engineer.

Flood Lamps Light Ice Trestle on Shore and Ice-Harvesting Field Nearly a Mile Distant



At Round Lake, Ill., Armour & Company of Chicago have installed four 1000-watt open flood lamps on top of the ice house, the direct and the indirect rays from which are used to light respectively the distant ice field and the ice trestle near the house. The ice field lighted by these lamps is about three-quarters of a mile long and half a mile wide. The lamps are mounted on adjustable standards so that any half-mile section of the lake in front of the house may be illuminated at will.

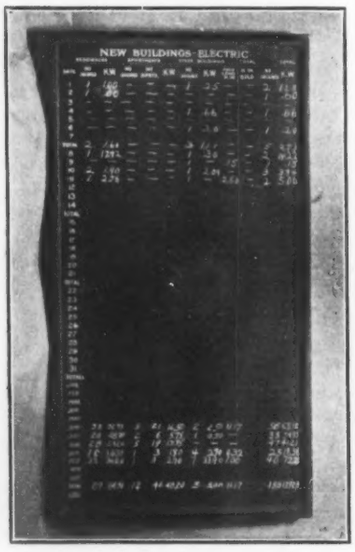
Before flood-lighting was tried at Round Lake it was necessary to employ an electrician and a helper during the entire ice-harvesting season, because poles were set and wires were strung to all parts of the lake as the work of harvesting progressed. Now the wages of these two men are saved because no skilled labor is required to operate the flood lamps. A further saving is effected since no equipment will be lost with the new system if a sudden thaw should occur. It is also reported that the number of accidents among the workmen has been reduced. So far this year no one has fallen into the open water. The total efficiency of the workmen is said to be increased about 25 per cent, since the scheme of general illumination eliminates the possibility of loafing unseen in the darkness. The entire flood-lighting installation at Round Lake was erected in about two hours. Lamps and equipment were supplied by the American Lighting Company of Chicago.

MARKETING ELECTRICITY

A Department on Selling Service and Widening the Use of Electrical Energy

Comprehensive Follow-Up Bulletin for New Building Services

The Cumberland County Power & Light Company of Portland, Me., maintains a bulletin board 5 ft. 4 in. long by 2 ft. 10 in. wide, as shown herewith, which shows the status of new-building services on every day in the month. One solicitor is detailed to follow all such new-building work, keeping in touch with the city building inspector, the local architects and the building contractors in the Portland district. He makes suggestions to see that the wiring specified is large enough to care for further needs in the fixture and appliance line, and as a result of recent personal work among architects he has considerably enhanced local interest in electric service and has done a good deal to insure more outlets than were formerly provided. The bulletin board shows in chalked figures the number of residences, apartments and other buildings secured for electric service on each day of the current month, with a total for each week, giving connected load data and totals as shown. A valuable feature is a monthly summary, also in chalked figures, at the bottom of the bulletin, with a total showing all necessary data for the fiscal year up to the beginning of the current month. The bulletin is mounted in the offices of the sales department.



INSTALLATIONS UNDER WAY

Motor Drive of the Small Sawmill

Extending Electric Service to Replace Steam in Four Such Plants Resulting in Central-Station Incomes Averaging $110 per Month per Mill

By A. A. Laughton

Manager Athol (Mass) Gas & Electric Company

The lines of the Athol (Mass.) Gas & Electric Company serve a territory situated in the north-central part of the State of Massachusetts and directly in the heart of a wood-growing section. For many years the standing timber in this part of the State has been cut off a little each year, using old-fashioned steam sawmills.

Recognizing the fact that there here existed an opportunity for the substitution of electric drive in place of steam, certain of these sawmill owners were approached with the idea of electrifying their plants.

Since the proposition was a new one in that section of the country, and in consequence practically unknown, it was found to be very difficult to arouse enthusiasm among the sawmill operators. Also, it was soon learned that in many cases it would be necessary to construct lines of considerable length in order to supply service

to the point at which it was desired to establish a given sawmill.

However, in spite of what seemed to be unsurmountable obstacles, the promoters of the plan soon found there were several very important factors in favor of the electrically driven sawmill. Chief among them was the elimination of the necessity of locating the mill near some source of water, as was necessary in the case of a steam outfit in order that the boiler might be supplied with feed water. With electric drive, also, no licensed engineer was required, and the many mechanical difficulties in the use of a steam unit were avoided.

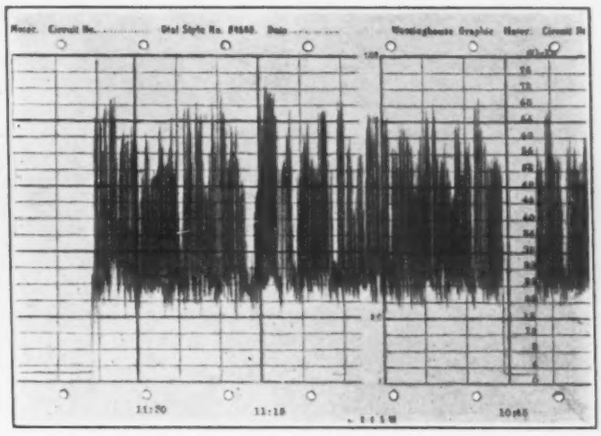
The first contract was, of course, the most difficult to secure. Under it the sawmill operator was furnished with energy at a pressure of 2300 volts at the rate of 2 cents per kilowatt-hour. Further, the central-station company agreed to build a mile of transmission line free, provided that all rights-of-way and poles required were furnished by the sawmill operator. If any additional line was required in excess of the first mile, the company agreed to construct it and lease it to the operator for a period not exceeding two years for the sum of $30 per 1000 ft., provided that the operator furnished the right-of-way and poles required. Standing trees were in many cases used as poles.

Under this agreement, the operator equipped his mill with a three-phase, 50-hp., 2300-volt motor, operating at 720 r.p.m. The saw, which was 56 in. in diameter, was directly connected, thus obviating any belt slippage. The installation worked perfectly, and it was found that the motor kept its speed exceedingly well, even when cutting through logs of large diameter. With the steam drive the engine would "lie down" very appreciably when large logs were cut, and the superiority of the electric drive over the steam drive in this instance resulted, on the average, in 20 per cent more wood being cut per day with the electric drive.

Another feature was the installation of electric lighting in the office and in the sleeping quarters of the sawmill crew. For this service a single-phase, 1-kw. transformer of 2300/110 volts was used.

Curiously, this electric portable sawmill became well known for many miles around within a very few days. Although the mill was situated at a point which was more than a mile from the highway, yet during the first two weeks of its operation fully 300 persons visited it, many of them coming long distances.

Within a few weeks from the time that this first electric sawmill was put into service there were two other similar mills in operation on the company's lines. The motors of each installation were 50 hp. in size, but some were designed for 220 volts as well as for 2300 volts.



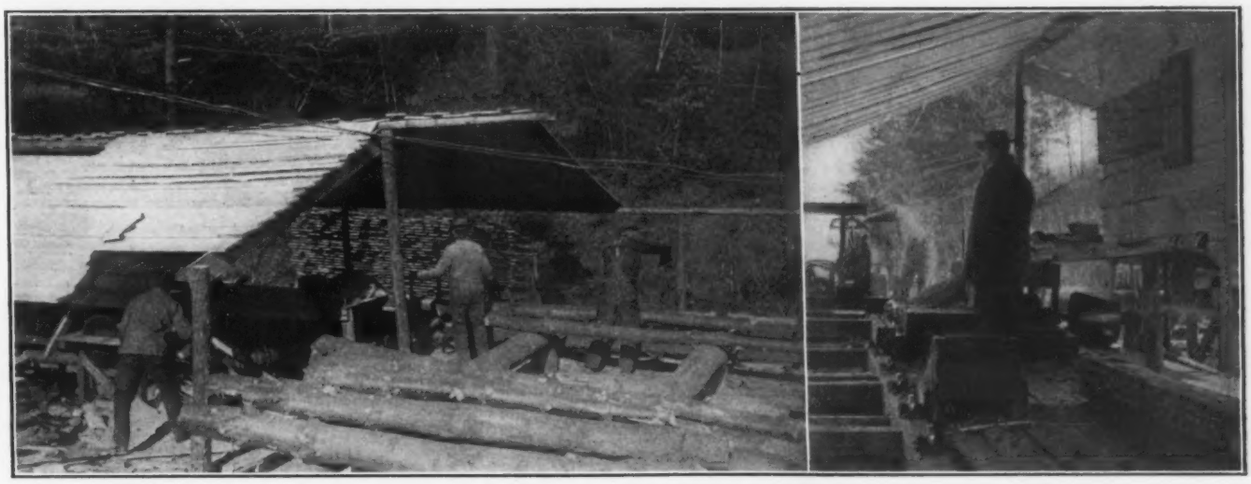
CHARACTERISTIC DEMAND OF SAWMILL AT ATHOL, MASS.

In the case of the 220-volt motors, step-down transformers of 2300/220 volts were furnished by the company without extra charge. The meters, however, were in each case installed on the primary side of the transformers. Some of the mills were belt-driven and some were directly connected, but in all cases with the latter arrangement a speed of 720 r.p.m. was the maximum employed. Besides the large saw itself, a small slab-saw and a high-speed blower were included in each mill's equipment, the latter being to blow away the sawdust.

With such a mill in operation and no logs being cut, a load of at least 16 kw. was developed. While cutting a log the load varied from 16 kw. to 75 kw. and was of a very fluctuating character. A recording wattmeter was connected with the circuit of one of the mills, and the accompanying copy of a graphic chart from it shows clearly the character of the load. This chart was made during weather of moderate temperature. It was found that slightly more energy was used in cold weather.

The wood cut by these mills averages about 85 per cent pine, and the logs vary in diameter from 8 in. to 24 in. The energy consumed by each mill in proportion to the feet of lumber cut was practically the same, and averaged 17 kw.-hr. per 1000 ft. The electricity which operated all of these mills was generated by water-power at the company's hydroelectric plant at Wendell Mass., which is situated on the Millers River.

At the present time there are four motor-driven sawmills in operation in the vicinity of Athol, the bills of which average $110 per month. Negotiations are now pending which will doubtless result in two more of these mills being served with electricity within a few weeks.



MOTOR-DRIVEN SAWMILLS LIKE THAT HERE PICTURED CONSUME ABOUT 17 KW.-HR. PER 1000 FT. OF LUMBER SAWN

FIG. 1—SIXTY SEWING MACHINES AND CUTTERS GROUP-DRIVEN BY ELECTRIC MOTORS

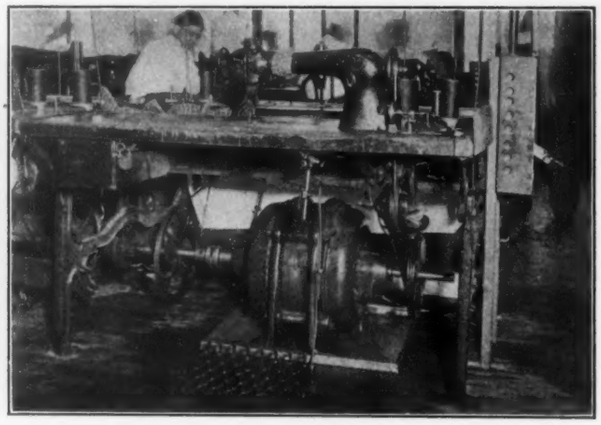


FIG. 2—ARRANGEMENT FOR MOUNTING MOTOR TO DRIVE GROUP OF SEWING MACHINES

Data on Motor Drive in Clothing Factories

Motors are hardly in evidence in the accompanying photograph of a clothing factory (Fig. 1), but every one of the sewing machines and cutters shown—some sixty in number—is operated by group-drive electric motors concealed beneath the benches. In this position they take up no useful space and yet obviate the necessity of dangerous and unsightly overhead shafts. Individual drive was not necessary in this case as the machines are operated almost continuously, hence the group-drive arrangement can be operated at nearly maximum efficiency. As the line shafts extend between parallel lines of benches, practically all possibility of operators' clothing being caught is removed. The motors are operated continuously during working hours, the starting and stopping of the individual sewing machines and cutters being effected by treadle-operated friction clutches. Each motor operates ten machines and is rated at 2.5 hp., 450 r.p.m. and 220 volts. A 2-hp. motor is used to drive a blower. Operating fifty hours a week, this equipment requires about 1375 kw.-hr. of energy a month on the average, or 81 kw.-hr. per connected horsepower. The plant is owned by Harris Brothers & Barnett, clothing manufacturers, New York City.

Generally similar conditions of drive, control and position of motors and line shafts exist in the clothing shops of the Heller Company and Reisman, Rothman & Bieber of the same city. The arrangement of the motor shown in Fig. 2 and its connections with the sewing machines are typical of each of these plants. A switch cabinet is placed near each motor, so it is convenient for the attendant to operate. As shown in this illustration, the machines are connected with the line shaft through friction clutches operated by treadles.

GROUP ARRANGEMENT OF MOTORS

At the Heller factory two 2.5-hp. motors are employed to drive about thirty-two sewing and cutting machines. These are used about fifty-three hours a week and consume 673 kw.-hr. of energy per month on the average, or 134.5 kw.-hr. per connected horsepower. In the Reisman, Rothman & Bieber factory five motors having an aggregate rating of 8.625 hp. are employed. One of these, an 0.125-hp. motor, drives a single sewing machine. Another unit rated at 1 hp. operates a blower, and the other three motors, rated at 2.5 hp. each, are connected for group drive to about forty sewing machines. This plant also operates fifty hours a week. The average monthly energy consumption is 1127 kw.-hr., or 129.5 kw.-hr. per connected horsepower.

The difference in energy consumption per connected horsepower for these factories may be due to several causes, among which are the number of hours each machine is operated, the number of machines connected per horsepower of motor rating, the weight of goods handled, friction losses in machine connections, etc. Energy for the foregoing factories is supplied by the United Electric Light & Power Company, New York City.

Uses for the Electric Fan in Winter

BY G. A. ROUSH

Most electric fans are packed away in the fall, to lie idle until the warm weather of the following summer calls for their reinstatement. To the average owner the fan is a comfort in summer but a nuisance in winter, because it takes up so much storage room. The fact that the electric fan may be applied quite as efficiently to overcome the cold of winter as the heat of summer is appreciated by comparatively few people, and the message is of importance enough to merit more attention.

Every form of artificial heating depends to a greater or less extent on a single principle—the transfer of the heat to the air of the room to be heated and its distribution through the rooms by means of the circulation of this heated air. In most cases the only circulation that is depended on is the natural circulation of the warm air, and as this tends to rise to the top of the room, the heating is naturally not regular and uniform throughout the room. Here is where the electric fan can be made use of, for it will serve for moving warm air away from the source of heat and distributing it through the room.

In cases where a base burner or other stove does not heat the room uniformly an electric fan may be set so that its current of air is directed over the stove and toward the part of the room most needing heat. The heated air from the stove will then be directed where it is needed, instead of ascending to the ceiling. In a hot-air-heating system, similarly, the tendency is for the hot air to rise from the hot-air vent to the top of the room. Hence the fan should be placed with its back to the vent if the register is in the wall, or the fan may be placed over the vent if the latter is in the floor. In this way the heated air will be directed toward the center of the room. With a hot-water or steam-heated radiator the fan should preferably be placed behind the radiator, so that its current of air is forced out through the radiator into the room. The fan cools the radiator—increasing condensation in the case of a steam system or cooling the hot water in a hot-water system—thus setting up circulation and causing more steam or hot water

to flow into the radiator. In this way the efficiency of the radiator is greatly increased, and its equivalent rating is raised much above that of such a radiator without the fan.

The following results were obtained in a recent test with a steam radiator so placed that the fan could be applied only to blow the cold air from the floor level onto the radiator, from which it was diffused into the room. Before the fan was used steam had been turned on for several hours and the thermometer had become practically constant at 56 deg. The fan (a 9-in. unit on intermediate speed) was then started and the thermometer observed. At the end of ten minutes it had risen to 63 deg., in twenty minutes to 67 deg., and within an hour it had reached 75 deg., where it remained. This was in a room about 14 ft. square, with one door opening into a hallway and a double door leading into another room, both open. The thermometer was hanging in the center of the room, behind the fan, where no direct current of warm air could strike it. After maintaining a constant temperature of 75 deg. for the greater part of the day, the fan was turned off, with all other conditions remaining unchanged, and in ten minutes the thermometer had dropped 5 deg. On re-starting the fan, the original temperature was regained in approximately the same time.

Central Station Encourages "Shop-at-Home" Movement with Discount Offer

In order to encourage and assist the "shop-at-home" movement inaugurated by the merchants of Thompsonville, Conn., during the holidays, Walter P. Schwabe, general manager of the Northern Connecticut Light & Power Company, made a special offer of a discount of one-half on all electric service consumed by special window displays or outside lighting. In his letter addressed to the local merchants Manager Schwabe wrote:

"We believe that window displays kept illuminated every night will attract passers-by at a time when they are at their leisure, and will yield a greater advertising return than day window displays only.

"We want to assist the merchants in making a success of the 'purchase-at-home' spirit and are willing to do our share. We, therefore, offer to all merchants making a special window or outside display a discount of 50 per cent on the amount of electricity for equipment used or added in excess of regular window or outside lighting."

Twenty-two Thompsonville merchants increased their lighting by additional wiring or the increase of existing wattage on this offer, and the results were very satisfactory to the storekeepers as well as to the company.

Moreover, Mr. Schwabe states, a number of merchants will use the added lighting permanently.

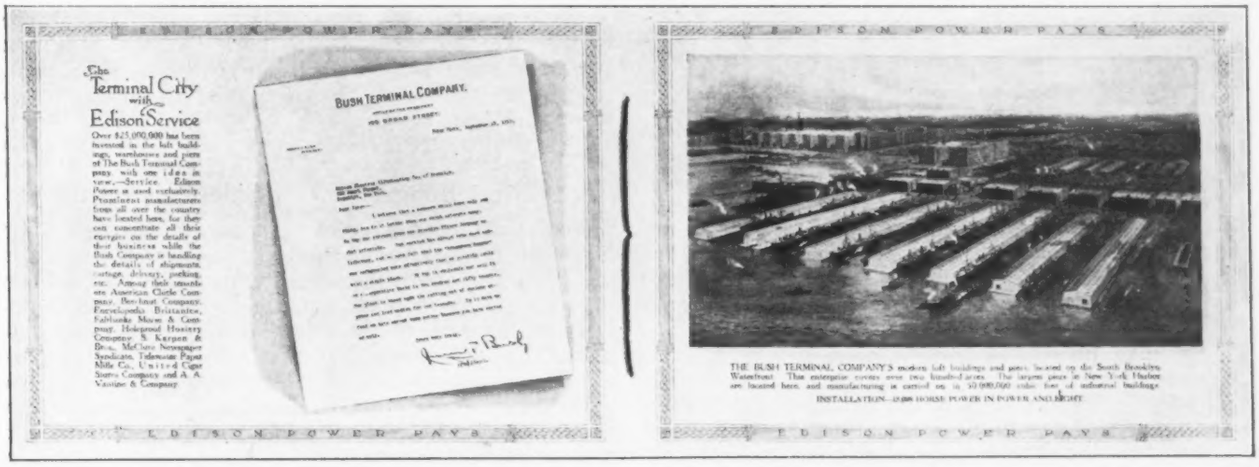
Proof that "Edison Power Pays"—The Customers' Testimony

One of the most impressive presentations of direct evidence that have ever been published by a central station in quest of power business is a booklet entitled "Edison Power Pays," issued by the Edison Electric Illuminating Company of Brooklyn. It is a clever combination of testimonials, showing the reproduction of a letter from the customer beside a photograph of the factory served, supported by a paragraph of descriptive matter covering the size of the installation, the period over which service has been rendered, and other general facts.

Only nine installations are featured, but ninety cases could not have strengthened the impression, for though in size the installations pictured ranged from 175 hp. to 18,000 hp. each, one of them is seen to be a very large modern industry, presumably representative of the most favorable conditions for the operation of a private plant.

In character the installations cited range through the manufacture of rope, hoisting machinery, clothing, tobacco, drop forgings, groceries, a bakery, a department store, dry docks, terminals and warehouses. It is evidence unquestionable that there must be something in the central-station power proposition, for if so many big men can save money by abandoning their private generating equipment, the small man can surely find profit in electric service. The pages reproduced here illustrate the great Bush Terminal, and the letter from the president of the Bush Terminal Company reads:

"I believe that a concern which does only one thing can do it better than one which attempts many. We buy our energy from the Brooklyn Edison Company on that principle. The service has always been most satisfactory, and we have felt that the 'break-down danger' was safeguarded more effectively than we could possibly do with a single plant. We buy electricity wholesale and sell it on a co-operative basis to 250 tenants. Our plant is based upon the cutting out of useless expense and lost motion for our tenants. Up to date we feel that we have served them better because you have served us so well."

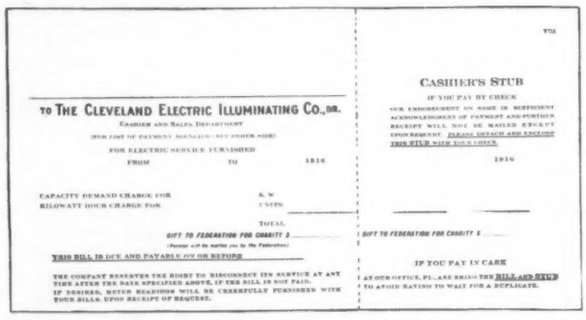


TWO PAGES FROM THE TESTIMONIAL BOOKLET, "EDISON POWER PAYS," ISSUED BY THE BROOKLYN EDISON COMPANY

Cleveland Illuminating Company Aids in Collections for Local Charities

The Cleveland Electric Illuminating Company, Cleveland, Ohio, has adopted a plan for collecting donations for the local charity society and thus removing a portion at least of the load from the shoulders of the officials of that organization. On its regular monthly statement forms the company has provided a line printed in red ink reading: "Gift to Federation for Charity, $.....". A corresponding line appears on the cashier's stub, and the donor receives a receipt from the company for his money on the bill itself. But, in addition to this, a receipt is also mailed to him by the society for the amount he has given. The company turns the money over to the organization in an itemized form, with the street addresses of all who donate.

The Cleveland company has participated in many un-


TO THE CLEVELAND ELECTRIC ILLUMINATING CO., DR.

CASHIER'S STUB

MONTHLY STATEMENT WITH SPACE FOR NOTING THE CUSTOMER'S CONTRIBUTION TO CHARITY

dertakings for the benefit of the local public, but the assumption of this phase of work for the Cleveland charitable organizations is something apart from anything else it has attempted.

Nearly 700 Washers Sold as Result of Window-Display Contest

Just before Electrical Prosperity Week the Hurley Machine Company of Chicago, Ill., offered three cash prizes aggregating $225 to the three dealers with the best window displays featuring the "Thor" electric washing machine during the week from Nov. 29 to Dec. 4. To enter the competition a dealer, of course, had to purchase a Thor machine for display purposes. The machines used for filling these window-display orders were finished in an especially attractive manner and were sold at the regular prices. Machines ordered for displays did not need to be paid for, however, until Feb. 1. Granting the dealers such a long payment period gave them a chance to sell the display machine and several others before remitting to the Hurley company.

All photographs of displays to be entered in the contest had to be in the mail by Jan. 5. Shortly after that date three judges—Sam A. Hobson of the ELECTRICAL WORLD, J. H. Ewing of the Ewing Press, and H. G. Carnahan of the Hawtin Engraving Company—selected the best photographs from those submitted and announced the following central-station companies as the prize winners: First prize, Arkansas Valley Railway, Light & Power Company, La Junta, Col.; second prize, Public Service Electric Company, Montclair, N. J.; third prize, Northern Indiana Gas & Electric Company, Hammond, Ind.

The first prize was given to the Arkansas Valley company because of the broad scope of its displays. The company had rented three large store windows, had used live models in its portrayal of the "Old Kitchen" and the "Thor Kitchen," and had put plenty of action into its exhibits. The second prize was awarded the Public Service Electric Company of Montclair, N. J., because its display conveyed an idea to the passerby at a glance. Figuratively the display said "Wash your good clothes in an electric washer. It does not wear them out or tear them." The Northern Indiana Gas & Electric Company's display, featuring an electric washer shown at the summit of "Mount Perfection," was awarded third prize mainly because in it its designer had been able to demonstrate marked artistic ability. The following companies received honorable mention: Sterling & Welch Company, Cleveland, Ohio; Winters Hardware Company, Fremont, Ohio; Chatham (Ont.) Gas Company, and the Denver (Col.) Gas & Electric Company. In no instance did the judges know the identities of the companies to which awards were being made until after the winning displays had been selected.

In results this campaign was the greatest the Hurley company has ever conducted. A total of 668 orders for washing machines which retail at $90 each was received.

Lumber Mill Installed Electric Yard Lighting After Burglar's Visit

A large lumber company in the State of Washington has for some time been supplied with electric motor service from the lines of the Puget Sound Traction, Light & Power Company's system, although operating its own lighting plant. This plant is shut down when the mill closes in the evening, necessitating the use of a lantern for the watchman in making his hourly rounds. Lighting service from the central-station system was suggested to the lumber company's manager so as to aid the watchman and reduce the fire hazard, but without avail. Some time later, however, a large piece of belt was stolen from one of the outbuildings, and after this incident it became an easy matter to persuade the manager to have lamps installed in the yards and buildings, not only eliminating the fire risk, but also serving as very good burglar insurance.

Restoring the "Dead" Electric Sign

A movement is on foot in the city of Baltimore to compel the owners of electric signs to burn them from dusk to 11 o'clock, the point having been raised by a member of the City Council that unlighted signs are a decided disfigurement to the streets and that the feature of electric signs which makes them acceptable to the public is their usefulness in the lighting of the streets and the general improvement in the night appearance of the city. He maintains that the issuance of a sign permit in a city is a contract between the merchant and the city which entitles the community to the full benefit of such lighting.

A Contest Suggestion for Sales Departments

The central-station sales manager who is cudgeling his brain for a different method of securing a new list of prospective appliance purchasers may be glad to hear of a plan used at Massillon, Ohio. O. A. Acuff, new-business manager of the Massillon Electric & Gas Company, recently inaugurated a contest among the company's customers by inviting them to see which of them could compose the most words from the letters in the slogan "Do it electrically." The winner of the contest made a list of 2898 words and received an electric silver coffee set as a prize.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Electrolysis of Underground Pipes and Structures

Results of Extended Research by the National Bureau of Standards—Electrolysis Mitigation Methods Applicable to Pipes and to the Railway Negative Return

WHEN the track of an electric railway is employed as the return conductor to carry the current from the motors back to the generating station, part of the current usually leaves the rails and chooses its own way back to the station through the earth. Such stray currents are likely to enter and leave metallic underground structures like gas and water pipes. Where the current enters a pipe no harm is done, the pipe being the cathode at that point. But where such stray currents leave pipe the pipe acts as an anode and, according to the laws of electrolysis, oxidation takes place at the anode, so that at such points the pipes are liable to corrosion and are in time destroyed.

The "electrolysis problem" was for a long time neglected in this country, and partly as a result of this it is now more serious than in those European countries which early met it by government regulation. During the last few years, however, much more attention is being given to this subject by railway companies generally. The Bureau of Standards has been engaged for some time past in a general investigation of the subject of electrolysis and its mitigation, the work being carried on by special appropriation by Congress. The outcome of this research is a very elaborate report of 143 pages, entitled "Electrolysis and Its Mitigation," by E. B. Rosa and Burton McCollum, published as Technological Paper No. 52 of the Bureau of Standards (issued Dec. 27, 1915).

Pipe Remedial Methods Only Secondary

Messrs. Rosa and McCollum emphasize that the principal reliance to prevent electrolysis must always be on proper construction and maintenance of the railway return circuit. Those remedial measures which are applicable to the pipe system can be regarded only as secondary means of mitigation of electrolysis trouble. In special cases, however, mitigation measures may be applied only to the underground structure.

After a critical discussion of the mitigation methods applicable to pipes, the authors conclude that of the various methods that have been tried none is suitable for general use as a primary means of preventing electrolysis troubles. The methods of chemical protection, cement coatings, cathodic protection and conducting coatings are regarded as substantially worthless in their present state of development. Surface insulation of pipes by means of paints or dips is not much more reliable, but insulation by putting the pipes in troughs or conduits filled with pitch may be used in special cases where the expense can be justified. The practice of placing all pipes as far as possible from railway tracks affords a certain measure of protection of which advantage should always be taken wherever practicable in laying new lines or relaying old ones, and the use of electric screens is often a valuable expedient in taking care of acute local cases of trouble in existing mains. These methods, with the exception of that relating to the proper location of pipes in new work, are suited only to special conditions, however, and are not usually to be considered as important factors in any general plan for electrolysis mitigation.

Insulating Joints and "Pipe Drainage"

The two methods of mitigation most commonly applied to pipe systems, and valuable under certain conditions, are the installation of insulating joints and the use of "pipe drainage." The essential features of the pipe-drainage system consist in connecting conductors at suitable points in the pipe system where the latter tend to become positive to the earth to take the current off the pipe through these conductors instead of permitting it to discharge directly into the earth. The conductors may either take the form of bonds connected directly between the pipes and tracks wherever the pipes are found positive to the tracks, or the conductors may take the form of special feeders running directly from the negative busbar out to various points on the pipe system.

Messrs. Rosa and McCollum conclude that pipe drainage is sometimes useful but should be used with proper restriction and with due precaution against setting up any dangerous condition either in the system drained or in neighboring systems. In general, in city networks where there are a number of independent underground systems to be protected, pipe drainage should be used as little as possible, the chief reliance being placed on mitigative measures applied to the railway negative return. The drainage of lead-cable systems will, however, usually be desirable, but these should always be drained by means of suitable insulated-feeder systems so arranged as to drain the least practicable current from the cables in order that neighboring structures may not be subjected to unnecessary danger thereby.

The most valuable mitigative measure that can be applied to pipe systems consists in the proper use of insulating joints, and the extensive use of such joints should be encouraged in new work and in making repairs. Precautions are necessary in their use, however.

Maintenance of Bonding

Of the methods applicable to railways the most important of those which have been thoroughly tried out are the adequate maintenance of track bonding, the proper number and location of power houses or substations, and, where the carrying capacity of the rails is not sufficient to return current to stations without excessive drop, the use of insulated negative feeders for the return of such current, these latter being much more economical than uninsulated feeders where large reductions of potential drop are required. The three-wire system has proved effective in relieving electrolysis and should prove satisfactory from the electrolysis standpoint where operating conditions are favorable to its use. Thus far, however, too little experience has been had with this system to justify more than tentative conclusions.

Such remedial measures as have been adopted in this country have usually been applied to the pipes, and in

general they have proved much less effective than measures used in certain foreign countries where regulations limiting voltage drops in the negative return have long been in effect and have been accompanied by substantial freedom from electrolysis troubles. Experience both here and abroad indicates that such limitation of voltage drop is necessary to a satisfactory solution of the problem.

VOLTAGE LIMITATIONS SPECIFIED

In defining the voltage limitations either the all-day average value or the average value for a period not less than one-half hour may be used. The former, however, is preferable, since it affords the best criterion of the actual danger involved and is also more satisfactory from the standpoint of the railway companies. A shorter period than half an hour is too short to give a satisfactory basis for voltage regulations that are to be applied to the railway systems.

In fixing voltage limitations some plan analogous to the zone system should be adopted, the voltage limits prescribed for the various zones being determined largely by the degree of development of the underground utilities in them.

The voltage drops either in the tracks or in the pipes and earth may be used as the basis of fixing limitations, but in general the latter is to be preferred. Under most conditions over-all voltages in railway tracks should be limited to about 2 volts to 4 volts, and the potential gradients should in general be restricted to about 0.3 volt to 0.4 volt per 1000 ft., these figures being all-day average values, or to corresponding values based on averages for a period of not less than half an hour. The higher over-all voltage limit will generally apply to the longer feeding distance and outlying districts, while the higher potential gradient limit can be permitted where feeding distances are relatively short. Potential drops on pipe systems should be, roughly, half of these figures.

MEASURING VOLTAGE DROP

In order that ready determination of voltage drop can be made at any time, potential wires should be installed running from some central point to selected points on the railway or pipe networks. These points should include the points of approximately highest and lowest potential, and preferably also some intermediate points.

Exemption from any regulations regarding track voltages should be made in special cases where local conditions make it improbable that any serious damage would result. Any regulations governing electrolysis mitigation should be made to apply not alone to the railway system, but should also define the responsibilities of the owners of underground utilities, since the latter can often contribute materially to the diminution of the trouble at a practically negligible cost.

Generators, Motors and Transformers

Dispersion Coefficient of Three-Phase Induction Motors.—E. A. BIEDERMANN.—The continuation of his long mathematical article on the estimation of the dispersion coefficient of three-phase induction motors and its application to their design. The author separates the dispersion coefficient into three components, termed the main, peripheral and flank dispersions, and shows how these components may be expressed in terms of the coefficients of self and mutual induction of the stator and rotor windings. The main and peripheral dispersions have been discussed in former installments. In the present one he takes up flank dispersion and then compares the dispersion coefficients, calculated from his formulas, with those obtained experimentally.—London *Electrician*, Dec. 31, 1915.

Lamps and Lighting

Radiation from Tungsten Filaments and the Mechanical Equivalent of Light.—IRVING LANGMUIR.—An abstract of an American Physical Society paper on a careful investigation of the phenomena of radiation from tungsten filaments, carried out on fifteen specially constructed tungsten lamps. The results were applied to determine the mechanical equivalent of light, which was found to be 0.00121 watt per lumen.—*Phys. Review*, January, 1916.

High Vacua.—A note on a recent British patent (No. 14,918, 1915) of the Siemens & Halske company. "A vacuum initially produced by a mechanical pump is increased or regulated by a method depending on the 'blowing' or repulsive action of heated surfaces, whereby molecules of residual gas can be given a mean velocity greater in one direction than in another, and thus propelled from one space to another."—London *Elec. Eng'ing*, Jan. 6, 1916.

Generation, Transmission and Distribution

Erection Plant for Quebec Bridge.—The conclusion of the illustrated article on the erection of the new Quebec bridge. This installment gives various details of the electric crane equipment used in the erection.—London *Electrician*, Dec. 24, 1915.

Vibration of Turbo-Generator.—STUNKEL.—An illustrated description of a case of very obnoxious vibrations of a turbo-generator due to mechanical resonance with the foundation. The trouble was solved by the installation of a "Pearson cushion," which is illustrated.—From *Vestnik Ingenerov* (Russia), translated in abstract by J. Vichniaf in *La Revue Elec.*, Oct. 1, 1915.

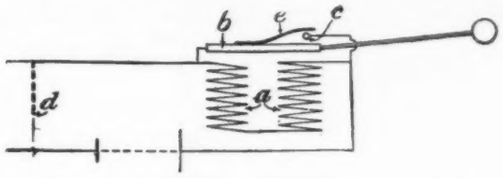
Traction

Electric Railways.—The first part of a long abstract of the James Forrest lecture delivered before the (British) Institution of Civil Engineers. Curves are given in the original paper showing the cost of electrical energy obtained from steam, electric and hydroelectric stations respectively. From these it appears that the curves of the total cost cross at a 20 per cent station load-factor, the hydroelectric station then showing lower costs than the steam station. Taking as a basis a station of 150,000-kw. rating equipped with five three-phase turbo sets of 30,000 kw. at unity power-factor, the author gives figures of running costs with fuel of 14,000 B.t.u. per ton and a load-factor of 50 per cent. It is shown that with coal at $1 per ton the total cost per kilowatt-hour is 0.456 cent, and with coal at $3 per ton it is 0.604 cent; thus increasing the price of fuel threefold increases the cost of electric energy by only 33 per cent. The first installment of the abstract deals almost exclusively with the Butte, Anaconda & Pacific 2400-volt railway.—London *Electrician*, Dec. 31, 1915.

Installations, Systems and Appliances

Ignition of Explosive Gas Mixtures by Electric Sparks.—J. D. MORGAN.—An abstract of a paper read before the Birmingham Section of the (British) Institution of Electrical Engineers. The author discusses the proportions of gas mixtures which are explosive and points out that it is necessary to distinguish between the energy which produces a spark and that quality of the spark, termed by him "incendivity," which enables the spark to cause ignition, and that the magnitude of the one is not a measure of the other. The prevention of ignition by sparks in the power and light circuits of mines has been thoroughly investigated, but the open sparking on the bare wires of bell systems needs more attention. Danger of gas ignition at the trembler of a bell has been minimized by the use of an

inclosing case, but experiments show that when using a bell of the ordinary type the break-spark which occurs on the bare circuit when a signal is given cannot be less dangerous than the trembler spark. An arrangement, illustrated herewith, has been found to give good results at both the trembler and the break. The action at the trembler is the reverse of the ordinary action. Instead of interrupting the circuit, the trembler short-circuits the magnets. The magnet windings are indicated by *a* and the spring-controlled armature by *b*. One end of the armature is connected to one end of the magnet coils, and the fixed contact *c* is connected to the other end. When the external circuit is closed, as indicated diagrammatically, at *d*, the magnet is excited and the armature is attracted. Near the end of the movement a spring blade *e* on the armature touches the fixed contact *c* and short-circuits the magnet. By means of its spring the armature is returned and the parts



ARRANGEMENT TO PREVENT GAS IGNITION FROM SPARK

c and *e* are separated. The action is then repeated and a vibratory motion of the armature is obtained. Only a very minute spark is produced at the trembler, and this is entirely negligible. The intensity of the single break-spark at *d* is not reduced, however, to the same extent, and although it is much less active than when the ordinary trembler construction is used in the bell, it is possible to produce ignition of an explosive coal-gas mixture. Notwithstanding such improvements as these, the author said that the complete solution lay in a suitable relay system. By using a small relay arranged to be actuated by a 4-volt battery he obtained perfect operation of the bell with a current of 0.1 amp. in the relay circuit. Sparking in the external circuit of the relay was quite insignificant, and no ignition of coal gas could be obtained. It was necessary to increase the relay current to 0.6 amp. before ignition of the explosive mixture could be produced.—London *Elec. Eng'ing*, Jan. 6, 1916.

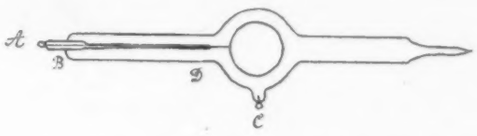
Switching of Induction Motors.—R. RÜDENBERG.—An illustrated English translation in abstract of his recent German paper on the surges caused by switching off non-synchronous motors.—London *Electrician*, Dec. 31, 1915.

Electrophysics and Magnetism

Theory of Thermo-Electricity.—A. E. CASWELL.—An abstract of an American Physical Society paper which gives experimental data on the Peltier emf. and thermo-electric power of pure bismuth and of alloys of bismuth and tin containing small percentages of tin. It is shown that if the mean free path of the electrons in an alloy is practically the same as in the pure bismuth, and if the electrons which take part in electrical and thermal conductivity are identical with those which take part in thermo-electric phenomena, we have a means of testing the thermo-electric formulas deduced from the electron theory by different investigators using different methods. The author uses his results for a decision between Drude's theory of the Peltier effect and the theory of J. J. Thomson and Richardson. He finds that Drude's formulas are satisfied, but Thomson's are not. He believes that this work definitely links the phenomena of thermo-electricity to those of conductivity in metals.—*Phys. Review*, December, 1915.

Units, Measurements and Instruments

Photoelectric Cells.—JAKOB KUNZ AND J. STEBBINS.—An illustrated description of their latest form of photoelectric cell, which is satisfactory with respect to sensitiveness, constancy, absence of dark currents, etc. It is illustrated below. The glass bulb is 3.4 cm. in diameter. It contains a small platinum cathode *C* and a platinum ring of 1.8 cm. in diameter as an anode *A*, which passes through a platinum cylinder *B*. This cylinder is necessary to lead surface and electrolytic currents of the glass to earth. Strips of tinfoil may be wrapped around the glass cylinder at *D* and the cathode *C* in order that dark currents may be suppressed. The tubes are connected to the mercury pump and heated two or three hours to 330 deg. C. to drive off the remaining gases. A small quantity of the pure alkali metal is distilled on the silver mirror of the cell, which is kept cool by cold water or ice, while at the same time the end *AD* of the cell is heated from 160 deg. to 240 deg.,



DESIGN FOR PHOTOELECTRIC CELL

according to the alkali metal, by means of a heating coil. The most sensitive cells have been obtained when the metal was deposited in a thin uniform layer. Pure hydrogen from palladium is then admitted and its pressure so adjusted that a potential difference of 280 volts to 400 volts between the electrodes produces a uniform glow discharge. As a rule the formation requires only one to three seconds for the maximum sensitiveness. During the formation the electrode *C* is negative and *A* positive. But in certain gases like ammonia and ethane a sensitive layer is also formed if the current is reversed. After the formation the gas is carefully pumped out and replaced by an inert gas, helium, argon or neon. The pressure is so chosen as to get a maximum sensitiveness. Four alkali metals have been used, namely, sodium, potassium, rubidium and caesium. The best results have been obtained with rubidium and neon.—*Phys. Review*, January, 1916.

Galvanometer.—LINDLEY PYLE.—A mathematical note on the correct formula for the damping factor in highly damped periodic motion of the coil of the D'Arsonval galvanometer.—*Phys. Review*, December, 1915.

Telegraphy, Telephony and Signals

Multiple Telegraphy.—O. SRNKA.—Illustrated notes on a system of multiple telegraphy in which not direct current but alternating current is used. The receiving apparatus on each station is tuned to a certain frequency so that only waves of this frequency are received at this station and not at any other station. By sending waves of different frequencies at the same time over the line different stations on the line may communicate with each other simultaneously without disturbing each other. The monotelephone is used as receiving instrument.—*Elek. u. Masch.* (Vienna), Nov. 14, 1915.

Determining Wave-Lengths in Wireless Telegraphy.—W. ECCLES.—A brief illustrated article describing a graphical method for determining the wave-length *l* of an oscillatory circuit from given values of inductance *L* and capacity *C*. The author describes a simple "alignment abac" for this purpose which has three scales, one each for *L*, *C* and *l*, which are so placed and graduated that points which satisfy the wave-length equation must lie on a straight line.—London *Electrician*, Dec. 17, 1915.

The Death of John A. Hill

John A. Hill, president of the Hill Publishing Company, New York City, died suddenly from heart disease Jan. 24, while traveling in his motor car from his residence in East Orange, N. J., to his place of business. He had been engaged as usual in business affairs and was to all outward appearances in perfect health.

Mr. Hill was fifty-seven years of age. For twenty-eight years he had been identified with technical journalism. The standards which he set for those enterprises that he established have done much to give editorial character and business strength to this branch of journalism. During his life he witnessed and had a large part in the development of this tremendous force for the upbuilding of the nation's industries.

Mr. Hill was a self-made man. He started to work in a country printing office when fourteen. Born in Vermont, he had a Yankee boy's liking for mechanics, however, and soon became half owner of a machine shop where he did repair work for a variety of local concerns. In 1878 he moved to Colorado and ran a locomotive on the Denver & Rio Grande Railroad, becoming later roundhouse foreman and assistant superintendent of motive power.

Mr. Hill's bent toward journalism and the printing office was shown by his founding in 1885 the *Daily Press* of Pueblo, Col., which he edited for some time. As a writer he had a forceful and breezy style and a thorough familiarity with practical matters. A number of articles were contributed at this time to a modest sheet called *Locomotive Engineering*, which was published in New York by a company that also published the *American Machinist*. In 1888 Mr. Hill was invited to come to New York and take charge of *Locomotive Engineering*. Later he purchased this paper and as editor and publisher achieved for it marked success. In 1896, however, Mr. Hill sold his interest in *Locomotive Engineering* to his partner, Mr. Sinclair, purchased the *American Machinist*, and laid the foundation for the present Hill organization. Mr. Hill's next purchase was *Power*. Later the *Engineering and Mining Journal* passed under his control. In 1912 he purchased the *Engineering News* from its founder and owner, G. H. Frost. A fifth journal, *Coal Age*, was established in 1911. Mr. Hill was also the president of the McGraw-Hill Book Company, a large publisher of technical books.

Some of Mr. Hill's practical views of life were reflected in his early writings, which were published in book form, among them "Stories of the Railroads" and "Jim Skeever's Object Lessons."

An enterprise in which Mr. Hill took great pride and to which he devoted some of the best energy of the last years of his life was the construction on the west side of New York City of the great building to house his publications, which was completed in 1914.

The story of Mr. Hill's life is a remarkable illustration of a man winning his way by sheer strength and ability. Born in the humblest surroundings and with only such education as was afforded by the country schools in the woods of Wisconsin nearly half a century ago, he well proved the saying of the president of one of the leading American engineering colleges that "life itself is an education." From his early boyhood, in whatever occupation he was engaged, his personality was such that his associates instinctively recognized him as a leader. The impression he made on those who met him invariably was that of a man of strength and force. By nature, however, he was modest and retiring. He was a genial man, fond of companionship, and with an endless fund of good stories, but social life had little attraction for him, and his two chief interests were the enterprise he had created and his home.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. L. Martin, local manager of the Oregon Power Company at Dallas, Ore., has been elected president of the Dallas Commercial Club.

R. M. Jennings, manager of the Oregon Power Company, Marshfield Division, has been re-elected president of the executive committee of the Marshfield Chamber of Commerce.

Leo Zimmer has been appointed superintendent of the municipal electric-light plant at Bath, N. Y., succeeding Archie Larrowe, resigned. Mr. Zimmer will take charge on Feb. 1.

John H. Roemer, former chairman of the Wisconsin Railroad Commission and now the head of the legal staff of H. M. Byllesby & Company, Chicago, Ill., is incapacitated with a broken leg.

C. E. Fahrney, manager of the Ottumwa Railway & Light Company, Ottumwa, Iowa, has been appointed a member of the Commercial Association committee which has in charge the promotion of a county fair for 1916.

Robert W. Boyd, who has recently been in consulting engineering practice in New York City, has been appointed secretary to Henry W. Hodge, the newly-appointed member of the New York Public Service Commission for the First District.

Robert O. Bentley, who has been superintendent of the Bergen (N. J.) district of the Public Service Electric Company, is now superintendent of the Newark district of the company, succeeding William K. Vanderpoel, who has been promoted to be general superintendent of the entire New Jersey system.

John A. Bookwalter, who has just been elected president of The James Leffel & Company, manufacturer of turbine waterwheels, steam engines and boilers, Springfield, Ohio, to fill the vacancy caused by the death of his uncle, John W. Bookwalter, has been the vice-president and treasurer of the company for a number of years. The new president is the son of Frank M. Bookwalter, who has been identified with the waterwheel company for the last forty-eight years.

T. W. Reynolds, formerly a member of the engineering staff of R. D. Kimball & Company, consulting engineers, New York City, has been appointed to have charge of the Toronto office of MacMullen, Riley & Durley, consulting engineers, Toronto, Canada. Mr. Reynolds' experience has been largely in the design of steam plants and mechanical systems for building service, and in his new connection he will have to do with the lay-out of plants for a number of Canadian government structures.

H. C. Riggs has resigned as head of the power sales department of the Toledo (Ohio) Railways & Light Company.

G. C. Miles has resigned as superintendent of the Kilbourn (Wis.) plant of the Southern Wisconsin Power Company to enter agricultural work near Dowagiac, Mich. Mr. Miles resigned on account of continued ill-health.

William G. Merowit, recently with the Northern Electric Company, Ltd., of Montreal, Canada, as power-apparatus sales specialist, has been appointed manager of the electrical department of the St. Louis office of the H. W. Johns-Manville Company.

U. S. Arnold, who for the last thirteen years has been connected with the Western Electric Company with headquarters at Dallas, Tex., is now the representative for the Commercial Electrical Supply Company of St. Louis in Oklahoma and Texas.

D. W. Blakeslee, who resigned as assistant professor of electrical engineering of the University of Arkansas, is now engaged in power-plant design for the H. Kappers Company, Pittsburgh, Pa. Mr. Blakeslee was formerly connected with the Westinghouse Electric & Manufacturing Company and with the Carnegie Steel Company.

M. C. Pierce has been appointed superintendent of the Kilbourn (Wis.) plant of the Southern Wisconsin Power Company, succeeding G. C. Miles. Mr. Pierce was formerly in the small-motor sales department of the Fort Wayne Electric Works at Fort Wayne, Ind. He is a graduate of the Sheffield Scientific School of Yale.

Frederic P. Vose, secretary of the National Electrical Credit Association and past-president of the Chicago Electric Club, is receiving the sympathy of his friends upon the death of his father, William M. Vose, who died suddenly in Chicago on Jan. 20. For many years William M. Vose was engaged in banking, but recently he had been engaged in the real-estate business with his two sons, Frederic P. Vose and Walter S. Vose.

A. B. Gates, who was formerly assistant electrical engineer of the Sanitary District of Chicago, is assisting Gardiner S. Williams, a consulting engineer of Ann Arbor, Mich., in appraisal work. Mr. Gates is a graduate of Purdue University, and upon joining the engineering staff of the Sanitary District after leaving college he conducted the arc-lamp photometric tests for the rehabilitation of Chicago's street-lighting equipment.

Max Loewenthal, who managed the Electrical Prosperity Week campaign in Los Angeles, has been appointed commercial electrical engineer by the Dohrmann Commercial Company of San Francisco. He will advise in regard to the purchase and sale of electrical appliances and undertake the training of salesmen, demonstrators and window dressers for the electrical departments of the ten stores of the Dohrmann company in central and southern California.

H. W. Gottfried, who was formerly connected with the manufacturing, production and commercial divisions of the Westinghouse Electric & Manufacturing Company, and who for the last three years has held the post of chief of the electrical department of the Compañia Ingeniera, Importadora y Contratista, S. A., representatives of the Westinghouse interests in Mexico, has severed his connection with this Mexican firm and has opened an office at Mexico City as commercial engineer and contractor on business pertaining to electrical machinery and accessories. Mr. Gottfried was a member of the charter graduating class of the School of Applied Science of the Carnegie Institute of Technology at Pittsburgh, Pa.

Dr. Ernest Fox Nichols, president of Dartmouth College, Hanover, N. H., has offered his resignation to the board of trustees to take effect at the close of the college year, when he will occupy a new chair in physics at Yale University. Dr. Nichols was born at Leavenworth, Kan., in 1869, was graduated in 1888 from the Kansas Agricultural College, and after graduate study at Cornell University spent three years at the University of Berlin. He received the degree of doctor of science from Cornell in 1897 and was professor of physics at Colgate University for six years before coming to Dartmouth College to fill a new chair in 1898. Dr. Nichols later became professor in experimental physics at Columbia University, and about six years ago he was made president of Dartmouth. He has performed many notable researches, his best-known achievement being the invention of a radiometer for stellar measurements, and is a member of many scientific societies.

H. C. Mason, general manager of the Benton Harbor-St. Joe (Mich.) Railway & Light Company, one of the pioneers of electric railway and lighting in the Central West, has resigned. Mr. Mason was born in Mason County, Ky., in 1860 and began his public-utility activities in 1881 as a conductor with the old Newport & Dayton (Ky.) Railway, a horse-car line 3 miles in length. Later he was advanced to be superintendent, and on this property he began his business association with W. Worth Bean. In 1889 Mr. Bean sold his interest in the Dayton property and purchased an old horse-car line in Benton Harbor, Mich. As superintendent of this property Mr. Mason installed an electric-lighting system which since has been extended so that it now supplies electricity to practically all of Berrien County, Michigan. In 1906 Mr. Bean and C. B. Holmes, of Chicago, who were associated with Mr. Mason, sold their portion of this lighting and railway property to the C. K. Minary interests. Mr. Mason continued with the property and was made manager. Soon after Mr. Mason's resignation took effect he left for California, where he has a home in Alhambra. After an extended vacation he will again return to active work.

Harry R. Westcott has opened a consulting-engineering office in the Chamber of Commerce Building, New Haven, Conn. His practice will include the investigation, design and supervision of the erection and operation of power stations, mills, electrical installations, etc., as well as engineering work connected with industrial and power projects from their inception to their completion. Mr. Westcott was originally associated with a firm of consulting engineers, then served as mechanical engineer with a large textile combine, later was plant engineer with one of the largest manufacturers of rubber footwear in this country, and recently has been superintendent of construction for the United Illuminating Company of New Haven, Conn., making extensive improvements in its plants. He has been retained by this company as its consulting engineer.

Walter S. Wyman, the new president of the New England Section of the N. E. L. A., was born at Oakland, Me., in 1874. After taking the electrical engineering course at Tufts College he was employed from 1896 to 1899 as assistant superintendent of the Maine Water Company, then becoming general manager of the Waterville & Fairfield Railway & Light Company. Mr. Wyman entered into partnership in 1901 with Harvey D. Eaton of Waterville, Me., under the name of the Messalonskee Electric Company, supplying electricity in Oakland and Waterville. In 1907 the Fort Halifax Power Company was organized and a 2000-kw. development made on the Sebasticook River in Winslow to supply the Lewiston, Augusta & Waterville Street Railway with energy, Mr. Wyman being secretary and treasurer of the company. In 1910 these and other properties were consolidated into the Central Maine Power Company, Mr. Wyman becoming general manager and treasurer. This company serves thirty municipalities, has about 15,000 hp. developed, and owns privileges of from 50,000 hp. to 75,000 hp. About 75,000 people reside in the territory, and the company does a considerable wholesale power business. Mr. Wyman has been active in the affairs of the Maine Electric Association and is president of the Augusta Board of Trade, also being a member of the American Institute of Electrical Engineers.

Obituary

Clarence A. Stimpson, assistant superintendent of installation of the Philadelphia Electric Company, died at the Presbyterian Hospital in that city Jan. 15, after an illness of about two weeks. He was born in Maine in 1861.

Florentine J. Machalske, an analytical metallurgist, died of heart disease at his home at Plattsburg, N. Y., on Jan. 16. Since November, 1912, he had been experimenting with a new electrical process for manufacturing steel which he hoped would revolutionize the steel industry. He was a member of many scientific societies in this country and Europe.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

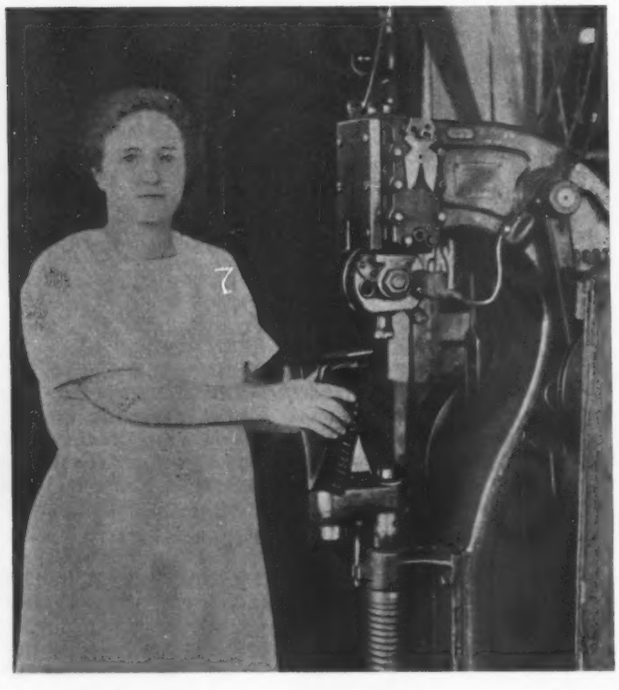
Electric Heating in Its Application to Shoemaking Machinery

The comparatively recent application of electric heat to shoe machinery for process work has brought about some marked economies in operation besides effecting other important advantages. Electric heat is supplied exactly where and when required, it does not vitiate the air like gas or steam, and in ironing its application gives a better finish to the leather than any of the other processes employed heretofore.

Electrical shoe machines and their uses include the following: The electrically heated backing press, used for the cloth backing of thin or defective leather; the turner's iron, for heating the upper leather when drawing it around the sole; the heated seam rubber, for smoothing the seams; the treeing iron, for smoothing the tops; the bench heater, for a similar purpose; the edge-setting machine, for setting the edges of soles; the vamp creaser, for producing corrugations on the upper side of the toe; electric heating attachment for the crimping machine; burnishing shank iron, for hand-finishing the shanks of shoes and also for ironing the bottom of oak soles; electric tool and knife heaters, the former used in connection with burnishing bottoms and wheeling shanks, and the latter for tip repairs, and electrically heated stamping and embossing machines for die-stamping shoe bottoms and printing on top facings.

Besides the above, most of which are complete units in themselves, several electrical heating attachments have been brought out for vamping, lasting, thread waxing, etc.

By the use of the backing press, which consists of a circular revolving metal disk on which an electrically heated half-round disk of the same diameter is imposed by the action of a foot lever, a large American shoe factory has successfully solved the problem of backing glazed kid, which for years had been attempted with little satisfactory result. The uppers, vamps, quarters, tops, etc., are cut and backed by being laid on the round lower disk, with adhesive cloth also cut to proper sizes upon the parts, and the heated iron produces the union of the two without the puckering which was incident to attempts at backing this kind of leather with flatirons. After the shoes have been made up, and while still on the lasts, they are given a final finish on the face of the leather with an electric treeing iron, which removes all piping and puckering.



BOTTOM-STAMPING MACHINE EQUIPPED WITH ELECTRIC HEATER

TABLE I—DATA ON ELECTRIC TREEING-IRON OUTFIT IN SHOE FACTORY

Rheostat Points	Watts in Iron	Net Cost, Nine-Hour Day
1	116.3	$0.0630
2	136.8	0.0730
3	152.7	0.0805
4	173.2	0.0910
5	191.5	0.0995

The electrically heated backing press, with rheostat control, gives any desired degree of heat with uniformity. This permits of work being turned over to young and comparatively inexperienced help with safety, because the heat can be established by the foreman. The operative can disregard the heat and apply himself to the actual work.

Plumping cloths are now made so as to be used with a small amount of heat. There is said to be less danger of underheating than of overheating. When the adhesive coating is overheated with too hot an iron the permanency of the union with the leather is impaired. There is, however, a reasonable amount of variation in heat required for the process, only care and common sense being needed to perform the work properly with the aid of the electric backer, whereas with a common flatiron its wide variation in heat makes constant painstaking care necessary.

The backing press enables the utilization of pieces of side leather containing neck wrinkles, which when put into the machine are given a grain effect, entirely concealing the defects. By this means leather is used that would otherwise be sold for scrap. It is said the saving is sufficient to pay for the machines in a very brief time.

A Lynn (Mass.) shoe factory producing 3000 pairs of shoes per day has installed electrically heated apparatus in several departments. In the lasting room, where the electric machines have been run several months, they have not burned or damaged a single shoe, where formerly there was constant liability of burning the leather. The operators like the new apparatus on account of its being absolutely sanitary. The foreman of this department pointed out that the use of clean irons is the secret of good results. With electric irons

a constant proper temperature is obtained, which is impossible with other types of machines. On patent-leather shoes a little vaseline is applied to prevent the irons adhering to the leather. Electric treeing irons are now being installed in this factory, which already operates an electrically heated stamping machine, a vamp-creasing machine, and a knife and tool heater, all made by the Simplex Electric Heating Company, Cambridge, Mass.

A large shoe factory at Drummondville, Quebec, is completely equipped with electrically heated apparatus, including the Expedite heel burnisher, Ross Moyer edge setter and Booth indenting machine. The manager reports that the electrical apparatus is not only economical, but that it is also more satisfactory. An important advantage which users of this type of apparatus recognize is that the heat is conveyed without loss in transmission and is maintained at constant temperature; there is no smut, and the iron imparts a finish that is not obtained with any other methods.

The electrically heated embossing machine has a distinct advantage over other types in that top facings may be embossed after having been stitched to the lining. This obviates waste of material which is inevitable when top facings are sent out of the factory to be embossed, as allowance has to be made to trim off the ends and center the design. Inasmuch as the degree of heat in the electric embosser is regulated by a rheostat controller, adjustment to the precise degree necessary for the perfect adherence of the embossing substance is possible.

The electric stamping machine is constructed and operated in much the same manner as the embosser, except that the heated die is impressed on the sole. Gas used for heating the die involved more or less burning or discoloration of the work.

The electrically heated crimping machine enables the operator to crimp equally well the lightest-colored stock and heavy-grain or split leather, either wet or dry. Specialists in shoe-factory equipment say that there should be an electrically heated iron in every lasting room for use in touching up shoes which may be found with slight process defects.

TABLE II—ELECTRICALLY HEATED SHOE MACHINES NOW MANUFACTURED

Machine	Application	No. Heating Units	Consumption in Watts	Voltages	Remark
Lining cementer		1	200	110	Maximum wattage, 200
Knurling machine	Knurl holder	1	126	110 and 220	Time, 10 to 15 min.
Stitcher	Wax pot	2	75	110 and 220	Maximum watts 613
	Take-up	1	250		Time, 20 to 25 min.
	Truck on wax pot	1	63		
	Shuttle	1	150		
Patent-leather repairer	Wax receptacle	1	63	110 and 220	Maximum watts, 63. Time 5 to 10 min.
Stitcher (old)	Take-up	1	200	110 and 220	Maximum watts, 476.
	Shuttle	1	126		Approx. initial heating
	Wax pot	2	75		time, 20 min.
Stamper	Turret	2	182	110 and 220	Maximum watts, 364. Time, 20 min.
Embossing machine	Die holder	2	121	110 and 220	Maximum watts, 280.
	Paste	1	38		Time, 5 to 10 min.
Upper-leather stamping machine	Die holder	1	200	110 and 220	Maximum watts, 200. Time, 5 to 10 min.
Indenter and burnisher	Knurl holder	1	126	110 and 220	Maximum watts, 126. Time, 10 to 15 min.
Welter	Wax pot	2	75	110 and 220	Maximum watts, 445.
	Looper	1	182		Time, 20 to 25 min.
	Tension	1	75		
	Thread tube	1	38		
Embosser	Die holder	1	300	110 and 220	Maximum watts, 300. Time, 10 to 15 min.
Goodyear stitch burnisher	Knurl holder	1	75	110 and 220	Maximum watts, 75. Time, 10 to 15 min.
Bobbin winder	Wax pot	2	100	110 and 220	
"Expedite"	Burnishing iron	1	425	110 and 220	Maximum watts, 625
	Wax pot	1	200		Time, 25 to 30 min.
Toe-softening machine	Boiler	1	750	110 and 220	

ELECTRICALLY HEATED EMBOSSING OR STAMPING MACHINES

The cost of operating shoe machines is a very important consideration, in view of the narrow margin of profit in shoe manufacturing. Figures presented at the New England Section convention, N. E. L. A., Sept. 14-17, and quoted in the ELECTRICAL WORLD of Oct. 9, 1915, page 816, indicate results obtained at Brockton, Mass. For an electric treeing-iron outfit the figures given in Table I were formulated at Brockton, where energy was obtained from the central station. In an electrified shoe plant at Haverhill, Mass., the net cost of operating an electric backing press was 38 cents per case of thirty-six pairs, or about 1 cent a pair.

The importance of properly installing the apparatus is recognized by the manufacturers of the electrical devices, who, as a rule, recommend that their own agents do the wiring. Operating costs, of course, depend very largely on the measure of economy with which electrical energy is consumed, and operators are taught not to waste the electricity. With the use of gas or steam a large percentage of the fuel or energy goes for naught, and there is no incentive for checking the supply, as it must be at the maximum of flow at all times to procure results. With electricity the initial demand is relatively heavy, but once heated a machine is maintained at the required temperature with a reduced flow of current.

The use of motors for driving shoe machinery is no longer argued, and most up-to-date shops are thus operated. One obstacle in the way of all electric operation of shoe factories was the claim that live steam was needed to heat both the building and the various machines which required heat. This argument has been met with the introduction of the electrically heated devices, the only requirement now being low-pressure steam for heating in winter, without the requirement of highly paid licensed attendants. Central-station power is therefore coming to be recognized as the logical energy for shoe manufacturing, with its relatively uneven demand and the many processes necessary to the completion of each pair of shoes.

Table II gives a list of electrically heated shoemaking equipment now on the market. The values given in this table apply to the so-called standard equipment. Practically all are subject to change in wattages to suit ideas and requirements of individual customers of this type of machinery. Variations in voltage of 5 volts in either direction are usually satisfactory. The heat and initial periods vary as the square of the voltage.

Electric Range with Elevated Oven

When a company which has been making stoves of the ordinary gas and coal types for years launches out on the manufacture of new models of electric-

FIG. 1—ELECTRIC RANGE WITH HEAT-RETAINING COOKER ATTACHED

heating and electric-cooking appliances and utilizes the results of its extensive study to produce stoves which are designed to meet the average housewife's requirements, the event is indeed worthy of particular comment. Such a concern is the Estate Stove Company of Hamilton, Ohio, which was founded in 1845 and has recently brought out a new No. 84 electric cabinet range, as it is called, shown herewith, which in design is very similar to its cabinet gas range and other types of electric ranges, ovens, air heaters, portable heaters, etc.

The oven of the range shown in the accompanying illustration is built on the fireless-cooker principle, being 2 in. thick and so insulated that radiation of heat is reduced to a minimum. The oven door is built like a door of a refrigerator and is just as heavily insulated as the walls. The temperature inside the oven may be 500 deg. Fahr., it is declared, while that outside of the wall is not more than 50 deg. Fahr. above the room temperature. With a bake oven of the type utilized on this range "rule-of-thumb" methods, which have generally been followed in baking by even the most expert domestic scientists, it is pointed out, may be completely abandoned. In place of the terms "slow oven," "quick oven" and similar terms commonly found in recipe books exact temperatures can be specified. A mercurial thermometer which shows the actual temperature of the inside of the bake oven is installed in the oven door, and a time-table which is provided with the range indicates the exact temperature at which food of various kinds should be placed in the oven, how soon thereafter the current should be turned off, and how long the food should be left in the oven. Thus the element of guesswork is entirely eliminated from baking. Heating plates are installed in both the top and bottom of the oven and are controlled by a single three-heat switch. The oven heats up to baking temperature, it is claimed, in ten to fourteen minutes, depending upon the character of baking which is to be done, and in most baking operations this temperature is approximately maintained without further use of energy until the baking operation is completed.

The oven is 18 in. by 18 in. by 12 in. There are four three-heat plates in the top of the oven, each of which is 2.25 in. by 15 in. The total energy consumption on high heat is 1500 watts, on medium heat 750 watts, and on low heat 375 watts. There are also four three-heat plates in the bottom of the oven, each of which is 6.5 in. in diameter. The total energy consumption of these plates is 2000 watts on high heat, 1000 watts on medium heat, and 500 watts on low heat. The total wattage of the oven, therefore, is 3500 watts on high heat, 1750 watts on medium heat, and 875 watts on low heat.

The broiling compartment, which is below the oven, is 18 in. by 18 in. by 6 in. The heating element, which is at the top of the compartment, takes 1500 watts on high heat, 750 watts on medium heat, and 375 watts on low heat.

Use is made of four heating plates in the cooking part of the range. These

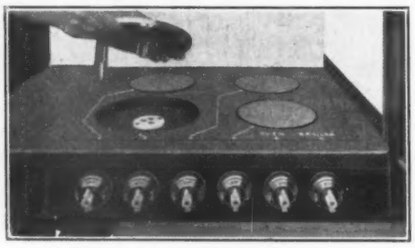


FIG. 2—HOW HEATING PLATES IN TOP CAN BE REMOVED WITHOUT TOOLS

can be removed and replaced without the use of tools, as shown in Fig. 2. The plates are of the inclosed "iron-clad" type and are said to give complete protection to the heating parts and afford a perfectly smooth surface for contact with cooking utensils. Three of these plates are 6.5 in. in diameter, each of them taking 650 watts on high heat, 325 watts on medium heat, and 165 watts on low heat. The remaining plate is 8 in. in diameter and is employed for rapid work. It takes 1200 watts on high heat, 600 watts on medium heat, and 300 watts on low heat.

The range is equipped with a high shelf over the cooking top, as shown in the illustration, white-enameled doors, white-enameled splasher back and white-enameled broiler pan. The cooking top (less side shelf) is 22 in. by 25 in.; the side shelf is 22 in. by 6.5 in. The height over all is 58 in., the width over all (less side shelf) is 50.5 in., and the depth over all is 30 in. The height to the cooking top is 30 in. and the shipping weight is 360 lb. The maximum rating of the range is 8150 watts, while the probable average demand according to the manufacturer is 3000.

The range may be equipped with a heat-retaining cooker, as shown in Fig. 1, if desired. This appliance is a cylindrical compartment, the outer wall being made of blue steel, the inner wall of aluminum with a space of 2 in. between the wall packed with insulating material. The top and bottom are also heavily insulated and the top is held tightly in place with three clamps. The appliance is hinged to the leg of the range and occupies a space under the body of the range where it is completely out of the way, but can be easily swung out, as shown in the illustration, to insert or remove utensils. By employing a three-section stew pan three vegetables can be cooked in this device at one time. The type H cooker, as it is called, is 11.75 in. high and 13 in. in diameter, weighs 50 lb., and has an energy rating of 500 watts.

Portable 30,000-Volt Oil-Testing Outfiit

A self-contained 30,000-volt portable oil-testing outfit, consisting essentially of a 1-kva. transformer designed for sixty-cycle, single-phase, 110-volt circuits on the primary side and to give a pressure of 33,000 volts on the secondary side, a potentiometer regulator for varying the applied low-tension current, a Weston alternating-current voltmeter with scale calibrated directly in kilovolts, a circuit-breaker and main switch, an oil cup and 1-in. disk electrode, has recently been brought out by the American Transformer Company, Newark, N. J. The type "Ts-6" oil tester, as it is called, is inclosed in a hard-wood case with reinforced corners and edges and is provided with two padlocked doors.

The center of the high-tension winding of the transformer is grounded to the core and the case, as is also the voltmeter coil. The maximum voltage strain then from either high-tension lead to ground is 16,500 volts, or half the maximum potential. The potentiometer regulator is of the slider, wire-resistance type. When the circuit-breaker and switch are closed the en-

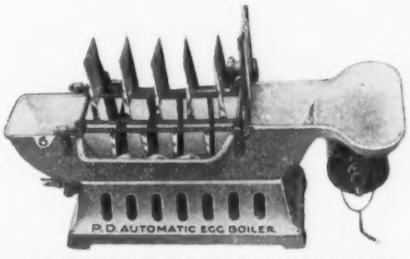
SELF-CONTAINED OIL TESTER

tire resistance of the regulator is thrown across the 110-volt line. One transformer primary lead is permanently connected to one end of the regulator and line, while the other primary lead is connected to the slider rod. By moving the slider to the right, the

resistance in series with the primary is cut out and resistance is added in parallel, thus increasing the voltage. The voltmeter, which is shown mounted directly over the potentiometer and pilot lamp, is of the dead-beat station type. The actual pressure applied to the meter varies from 0 volt to 100 volts, but the scale readings are calibrated in kilovolts as ascertained from the definite ratio between the voltmeter coil and the high-tension winding of the transformer. The high-tension terminals at the top of the box are brought up directly to a treated wood inside cover. The tips of these terminals are slotted to receive the electrode arms of the oil gap. The container is turned out of a solid piece of insulating material which, the manufacturer claims, is thoroughly treated. The electrode arms are threaded directly into opposite ends of the container and tipped on the inside with removable 1-in. disks, the separation of which can be adjusted by means of clamping nuts. A 1/10-in. steel oil gage is also provided. The door at the front of the box gives access to the voltage regulator, switches and meter, and the door at the top of the box enables one to get at the oil-cup electrodes and high-tension terminals. The net weight of the outfit is 205 lb., and the over-all dimensions are 18.5 in. by 19.5 in. by 21.5 in. high.

Motor-Driven Egg-Boiling Device

An egg boiler which is provided with paddles driven by a motor, as shown in the accompanying illustration, and controlling the length of time the eggs remain in the boiling water, has been developed by the Hamilton-Low Company, 145 East Forty-second Street, New York. The machine is absolutely "fool-proof," the manufacturer points out, and is far superior to the ordinary clock-controlled machine. The boiler is divided into six compartments by the paddles. When the eggs are placed in the No. 1 compartment, which is the nearest to the drain board, they are immersed in boiling water one minute; in the next compartment they are immersed two minutes, and so on. After the eggs pass through the boiling water



ELECTRICALLY CONTROLLED EGG BOILER

they are delivered to the drain board. Each compartment is designed to take six eggs at a time. The paddles are of German silver and are carried on a chain which is driven by the motor through a shaft with a worm gear. Use is made of a Robbins & Myers motor rated at 1/40 hp. The base and body of the machine are of cast iron which is handsomely finished and nickel-plated. The traveling chain, sprockets and trimmings are of brass. The base of the machine is 20 in. long by 9.5 in. wide, while the tank, including the drain board, is 32 in. long. The height from the bottom of the base to the top of the tank is 11.5 in. The machine complete weighs 80 lb. Fittings are provided on the boiler for gas or steam heating as desired.

Electric Hoist

In the design of the type I-5 500-lb. hoist, as it is called, safety requirements and economy in operation have received special attention. The hoist is light in weight and is particularly well adapted for use over such tools as lathes, planers, boring mills, drill presses, etc. An upper-limit device of the lever type is provided, which positively returns the controller, it is asserted, to the "off" position when the hook has reached the upper limit of

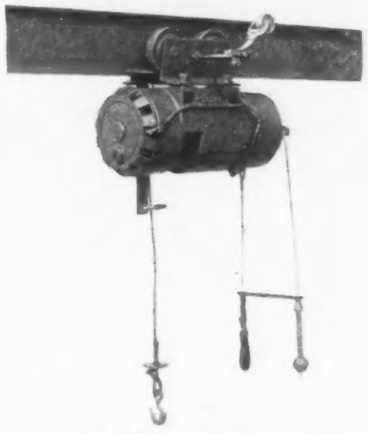
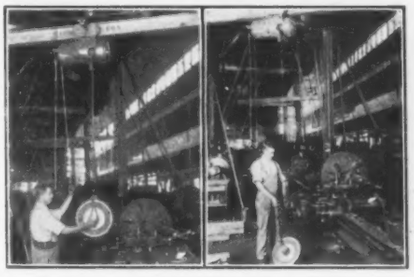


FIG. 1—500-LB. ELECTRIC HOIST

travel. The machine is equipped with a mechanical brake of the disk type which is so designed that the brake is released when the controller is turned to the "on" position and is applied when the controller is turned "off." Provision is made so that a load on the hook cannot overhaul the drum. The operating ropes are equipped with arrows which show the direction the hook will move in when each rope is pulled. Furthermore, the "up" rope is fitted with an elongated handle and the "down" rope with a spherical handle, as shown in Fig. 1, to indicate by the feeling which is the correct rope to pull at any time. This feature allows the operator to give his entire attention to the material being moved, as the instant a controller handle is grasped the direction the hook will take is indicated.

By means of a hoist of the type shown in the accompanying illustration, the manufacturer points out, the material can be moved in a very short time, thereby reducing the period the tool is idle, increasing its output per year, and keeping the efficiency of the machine operator at the maximum. The hoist is provided with one rope and operates at a speed of 25 ft. per minute. It will lift an object through a distance of 25 ft., and the maximum number of lifts per hour that can be made is fifteen. The machine is operated by a 1-hp. motor. Use is



FIGS. 2 AND 3—HOIST LIFTING GEAR FROM LATHE AND FLOOR

made of a frame consisting of a single iron casting in which are cast recesses for the gears, drum and motor. All bearings are of bronze, easily removable and automatically lubricated by oil. The drum is of cast iron with deep flanges and is keyed to the driving shaft. It is rigged with flexible-steel 0.25-in. crane rope.

All bearings and gears are lubricated by oil, the gears and adjacent bearings by the splash system and the other bearings by the chain oiling system. The service brake is of the multiple-disk type and is held on by a spring when applied and removed from the controller lever by a cam when not applied. The brake is automatically placed in position at all times when the controller is turned "off" and remains in position until the controller is again turned on.

The hoist is being made by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York.

Electric Heating Stove

An electric stove of attractive design which is especially adapted for heating bathrooms, offices, small rooms, etc., requiring a moderate amount of heat is shown herewith. The No. 30 "Quick-heat" stove, as it is called, is 12 in. long, 12 in. high and 6 in. wide. It is rated at 6 amp. at 110 volts and is

SMALL ELECTRIC HEATER

equipped with 8 ft. of cord and a separable plug so that it can be attached to any ordinary lighting socket. Use is made of a perforated jacket of steel which is provided with an oxidized copper finish. The ornamental ends are of cast metal and nickel-plated and

polished. The heating core within the perforated jacket becomes red hot when the circuit is closed and gives a ruddy glow. Nothing can come into accidental contact with the core. The heater is provided with an ornamental cast-iron top with an open flat surface which is very useful for warming small vessels or heating towels, thus making it an ideal stove for sick-room or nursery use. The stove is being placed on the market by the Quick Electric Heater Company, Cincinnati, Ohio.

Machine for Washing and Drying Clothes

An interesting departure from the ordinary type of laundry apparatus is the machine shown herewith, which not only washes the clothes but also dries them in the same tub without the need of the operator handling the clothes or putting her hands in the hot, soapy water. The clothes are first washed by means of vacuum cups and then are dried by centrifugal force. The machine consists of two tubs, both of which are of sheet copper, tinned on the inside to prevent corroding. The outside tub, which is double-seamed and soldered to prevent leaking, serves as the container of the washing solution, while the inside tub holds the clothes. While the cups are working up and down, the inside tub is slowly revolving, so that the cups work evenly on all the clothes. The inner tub is perforated and is about 1 in. above the outside tub, thus permitting the washing solution to be forced through the clothes and perforations of the tub instead of against a solid bottom. After the clothes have been washed (the operation usually requiring ten or fifteen minutes), the vacuum cups are removed and the inner tub is raised above the water to what is called the drying position. The inner tub is then revolved at the rate of about 750 r. p. m., and the water is forced from the clothes through the perforations by centrifugal force. A full tub of clothes can be dried more thoroughly, it is declared, in thirty seconds than can be done by a wringer, and sufficiently, it is asserted, so that ordinary flat work is practically ready for the iron. All operations of the machine are simple and are said to be virtually "fool-proof." The inside tub is raised or lowered with a foot lever, which automatically locks in both positions and automatically connects and disconnects the mechanism when washing or drying the clothes, one lever controlling both processes. Friction drive is employed to prevent the overloading of the ⅛-hp. motor which is used to drive the machine. The shaft which operates the vacuum cups is so connected that it can be stalled without damaging the motor or machine. The washer is being made by the Home Specialty Manufacturing Company, Cleveland, Ohio.

FIG. 1—VACUUM CUPS USED FOR WASHING

FIG. 2—INNER TUB RAISED FOR DRYING

Large Lifting Magnets

When the so-called "Mississippi" type of Cutler-Hammer magnet performed the feat of salvaging a boatload of barbed wire and nails from the muddy bottom of the Mississippi River in 1907, the ruggedness and water-tightness of this class of magnets received a severe test. Since then no important changes have been made in the design of the magnets, but recently the maker, the Cutler-Hammer Clutch Company of Milwaukee, announced the development of a new series of magnets of the same kind of construction with lifting capacities ranging from 20 per cent to 60 per cent greater than before. The lifting capacity, for instance, of the 62-in. magnet as given up to the present time has been about 2600 lb. to 3000 lb. It has been now increased to 4000 lb. and over. This increase in lifting capacity permits the handling of more material in the same time or the same amount in a shorter period. It also reduces the number of magnets, cranes and crane operators needed, since in many cases two of the new magnets can do the work formerly done by three.

WATERPROOF LIFTING MAGNET

Gas-Filled Lamps

The nitrogen and argon products utilized in incandescent lamps recently developed by the Triumph Lamp Works, 149 Palisade Avenue, Union Hill, N. J., are prepared by what the manufacturers describe as a simple and efficient method, which consists practically of maintaining the gases at a very low pressure and then passing them over certain liquids preparatory to admitting them into the bulbs. The lamps, one of which is shown herewith, are being made in ratings of 40 watts, 60 watts, 100 watts, 200 watts and 300 watts for from 100-volt to 125-volt operation. They are of rugged construction, it is claimed, and operate at high efficiency. The 25-watt and 40-watt units have been so designed that they can be utilized at high temperatures, with a useful life, it is asserted, of from 500 hours to 700 hours.

GAS-FILLED INCANDESCENT LAMP

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Engineering Bodies Aiding to Take Census of American Factories as Defense Measure

The census of American factories available for the manufacture of munitions of war shortly to be undertaken through the aid of the five national engineering societies, in line with a policy of industrial preparedness for the national defense, was outlined by W. L. Saunders, vice-chairman of the Naval Consulting Board and vice-president of the American International Corporation, before the New York Trade Press Association, Jan. 20.

Mr. Saunders suggested that in each factory suitable for the purpose a corner be set aside for special tools, gigs, sketches, models, etc., of the product which the plant might be called upon to make in event of war, and that a certain number of these articles be manufactured each year upon governmental order to insure the smooth working of the plans for industrial preparedness. Already such a census taken in the State of New Jersey has revealed the presence of some 880 factories suitable for making war munitions and supplies, and with the aid of the great engineering associations it is hoped to secure soon a complete record of the facilities of the manufacturing plants of every State.

Electrical Exports During October

The exports of electrical goods of American manufacture during October, 1915, as reported by the Bureau of Foreign and Domestic Commerce, totaled $2,145,594. This value, which is slightly greater than the average for the first ten months of 1915, exceeds the figures for October, 1914, by $650,000, or 42 per cent.

For the first ten months of 1915 the exports of electrical goods amounted to $19,386,325, or approximately $2,700,000 more than for the corresponding period of the previous year. The increase amounts to 16 per cent.

TABLE I—VALUE OF ELECTRICAL EXPORTS FOR OCTOBER AND FOR TEN-MONTH PERIOD

Articles Exported	October		Ten Months Ended October	
	1914	1915	1914	1915
Batteries	$69,061	$82,554	$532,439	$1,069,932
Dynamos or generators	131,286	137,445	1,997,707	1,696,958
Fans	6,684	34,042	278,357	297,956
Insulated wire and cables	144,906	201,856	1,150,653	2,284,634
Interior wiring supplies, etc., including fixtures	47,551	63,397	483,111	726,434
Arc lamps	9,846	1,219	41,180	18,461
Carbon-filament lamps	4,625	8,516	78,655	112,980
Metal-filament lamps	42,007	115,105	191,624	654,161
Meters and other measuring instruments	34,418	56,272	104,125*	503,553
Motors	229,605	290,623	2,691,855	2,752,384
Telegraph instruments (including wireless apparatus)	9,454	30,171	88,095	110,535
Telephones	64,544	72,493	994,384	792,532
Transformers	40,655	31,540	756,260	483,264
All other	660,150	1,020,361	7,309,384	7,882,541
Total	$1,494,792	$2,145,594	$16,697,829	$19,386,325

*Figures cover pe iod beginning July 1.

The principal increases in October, 1915, over the previous October were in insulated wire and cable, 39 per cent; wiring supplies, 33 per cent; metal-filament lamps, 174 per cent, and meters, 219 per cent. During the first ten months of 1915 the principal increases over the first ten months of 1914 were in batteries, 100 per cent; insulated wire and cable, 99 per cent; wiring supplies, 50 per cent, and metal-filament lamps, 240 per cent.

The exports were less during October, 1915, than during October, 1914, in arc lamps and transformers, and during the first ten months of 1915 in generators, arc lamps, telephones and transformers.

TABLE II—EXPORTS OF MOTORS AND INSULATED WIRE AND CABLE DURING FIRST TEN MONTHS OF 1913, 1914 AND 1915

	1913	1914	1915
Motors	$4,036,134	$2,691,855	$2,752,384
Insulated wire and cable	885,339	1,150,653	2,284,634

The export trade, however, is still far behind what it was when Europe was at peace. During the first ten months of 1913 American manufacturers exported electrical goods to the value of $23,719,904. This is about $4,350,000, or over 20 per cent, more than during the similar period in 1915. In comparing the 1915 figures with the 1913 figures it was found that the exports of batteries, insulated wire and cable, wiring supplies and metal-filament lamps had increased enormously. The export of telegraph instruments, including wireless, had increased slightly. Everything else, as far as the records show, was exported in less quantity than before. The greatest falling off occurred in the exports of motors, telephones and miscellaneous equipment.

One feature which a study of the 1913, 1914 and 1915 figures revealed was the increasing importance of insulated wire and cable exports in comparison with what used to be the most important of electrical exports, namely, motors. The figures are given in Table II herewith. In 1913 the exports of motors represent 17 per cent of the total electrical exports and insulated wire and cable but 3.7 per cent. In 1914 motors represented 16.2 per cent and insulated wire and cable 6.7 per cent. In 1915 motors represented 14.2 per cent and insulated wire and cable 11.8 per cent.

Patents in Germany

Arthur von Briesen, who for many years was chairman of the Merchants' Association's committee on the protection of industrial property, makes the following statement to the Merchants' Association of Greater New York regarding the granting of patents by Germany:

"I am informed that many inhabitants of the United States believe that the German Patent Office does not accept applications for patents, trademarks or designs submitted by Americans or other persons residing in the United States. Such a misleading and erroneous report is perhaps based on the fact that British patent agents are prohibited from doing business with Ger-

many for foreigners and from transmitting orders received from abroad to Germany, such dealings being considered by Great Britain as 'trading with the enemy' and punishable.

"The fact is that the German Patent Office accepts all applications from the United States, and even from subjects of hostile belligerent states. The safest way of filing cases in the German Patent Office is to transmit them through American solicitors direct to Germany."

Increasing Demand for Electric Wires

There are thirty-seven manufacturers of insulated wire in America and their output, despite their equipment and twenty-four-hour operation, cannot equal the demand for this important electrical product. Edwin W. Moore, president of the Electric Cable Company, in discussing this situation, said recently:

"The gross income in the past year of the electrical industry and service must have totaled more than $2,500,000,000. This includes central stations, electric railways, telegraph and telephone service, electrical manufacturing and the like. This will give some idea of the vast sum which is tied up in electrical interests in this country. The income from the lighting industry alone last year was $360,000,000. Electric railways, which are knitting the country more closely together than ever, had receipts of $700,000,000. The telegraph and telephone service brought in $350,000,000.

"Our interest as makers of insulated wire lies in the fact that every kilowatt of electricity sooner or later passes through an electrical conductor. The electric locomotive in the mine, the motor in the factory, the electric heating iron or one's electric light—all reach to the source of power generation through insulated wire. Naturally we have kept in touch with conditions throughout the country, and we have found that the demand for electricity, and, of course, for wire, has proved a most accurate measure of the country's recent commercial expansion. There can be no important developments of building operations without a large demand for insulated wire. Increased activity in mining operations is similarly evidenced. Manufacturing is turning to motor drive as more efficient than shaft drive —a further demand for insulated wire.

"There are two phases in which we are interested—the industrial demand for electricity and the demand in the home. The latter is just as much a measure of prosperity as the former. When times are good the housewife is in a receptive mood for the purchase of electrical devices as short-cuts to a number of house operations. When times are not so good common sense in the matter may be overruled by an illogical fear of extravagance, and she may go back to costly antique methods of toasting bread, ironing, etc.

"To put it in a nutshell, the better the times, the greater the amount of electricity used; the more electricity, the more wiring. The manufacturers of wire in this country have doubled their output in six months—on orders coming from within the country, not from without. The export of insulated wire is trifling compared with the volume of the demand created by conditions in our own country.

"This has a deeper significance than the gain to the industry itself. The demand for electricity is a sign of progress. While we may look upon conditions across the sea as an unfortunate misuse of science, let us not forget that the triumphs of our electrical engineers and chemists are steps forward by which every part of the community benefits, so that we can regard the output of the insulated-wire industry as an actual contribution to the country's welfare."

Public Service Commission News

Pennsylvania Commission

According to a decision of the Pennsylvania Public Service Commission, public-utility companies in Pennsylvania cannot furnish lighting service to churches at a lower rate than to the general public. The decision was a result of the application for the approval of a contract between the Allegheny Valley Light Company and the borough of Parnassus. The decision states that the rates at which the Allegheny Valley Light Company agrees to furnish electric-light services to the churches in Parnassus are at variance with the rates set forth in the published tariffs of this company on file with the commission. By the express terms of the law the filed rates are made the legal rates, and the different rates for this service especially provided for under the contract submitted for approval were held to be discriminatory and contrary to the law.

Vermont Commission

The Vermont Public Service Commission has dismissed the petition for the incorporation of the Central Power Corporation for the development of water-power on the Middlebury River, on the ground that no territorial limits were included in the proposed corporation. The opinion says: "If this certificate were granted, the corporation would be endowed with the right of eminent domain as conferred by the acts of 1915 anywhere within the territorial limits of the State. Further, we are of the opinion that, without regard to the question of eminent domain, it would not be conducive to the public good to grant any public-service corporation of the kind and character of the petitioner a roving charter to operate anywhere within the limits of the State of Vermont. Consequently we are of the opinion that this petition should be dismissed, and it is ordered that the petition be dismissed."

Indiana Commission

Under a ruling made long ago by the Indiana Public Service Commission that so long as an electric company operating under an indeterminate permit keeps its plant in good condition and abides by the commission's rate ruling the commission will tolerate no competitors in the same field without sufficient cause, the commission has decided that the city of Elkhart has a right to adopt such plans for lighting as it sees fit so long as the plans are reasonable—excepting that the city cannot provide for municipal ownership nor can other companies than the Indiana & Michigan Electric Company bid on the city lighting contract. In case, however, the lighting company refuses to bid by a certain date, then, upon petition by the city, the commission will grant others than the company or the city the right to construct and own the street-lighting equipment. The city is now compelled to take bids on a flat-rate basis.

New Jersey Commission

The New Jersey Board of Public Utility Commissioners has ordered the Wildwood Gas Company not to discontinue service in the future without giving the subscriber at least three days' written notice. It holds that the present practice of arbitrarily discontinuing service without notice is unjust and unreasonable. The company has also been ordered to modify its regulations so that consumers will only be charged the minimum for each entire month and such proportion of the minimum for the first and last month in which service is given as the number of days during which the service is connected bears to the number of days in the month or months. Heretofore consumers have been charged the full monthly minimum.

Railway Electrification in Great Britain.—At the end of 1913 there were eighty-three electric locomotives in use on British railways, 1019 electric motor cars and 1467 electric trailer cars.

Topeka Arcs to Be Replaced with Tungsten Lamps.—Topeka (Kan.) officials have decided to replace gradually within the next few years the city's ninety-four miles of arc-lamp lighting with tungsten lamps.

World's Production of Copper More Than a Million Metric Tons in 1915.—The world's production of copper in 1915 has been estimated at 1,061,000 metric tons. This is about 137,000 tons more than was produced in 1914.

Large Model Electrical Apartment House for New York.—Plans are being drawn up for a model sixteen-story apartment house soon to be erected in New York City in which electricity will be employed in every possible way, including cooking and refrigeration.

Cheaper Electricity in Berlin.—The Berlin (Germany) electrical works, which supply Berlin with electric energy and are owned by the city, are planning a reduction in the rates to large consumers. The new rates, it is expected, will be as low as 1.4 cents per kilowatt-hour. The output of the works has increased from 37,000 kw.-hr. in 1885 to 267,600,000 kw.-hr. in 1915.

Exports of Copper in 1915.—The total exports of copper in 1915 were 276,344 tons, a decrease of 23.3 per cent compared with 1914. France took 102,440 tons of the 1915 exports, or 40 per cent more than she took in 1914. Great Britain took 80,985 tons in 1915, a decrease from 1914 of nearly 7000 tons. Russia took 20,456 tons in 1915, compared with 425 tons in 1914.

Town Boards and Not Superintendents of Highways Grant Franchises—Franchises must be sought from town boards and not from superintendents of highways, according to an opinion from Justice Howard of the Appellate Division of the Supreme Court, made for the Public Service Commission for the Second District of New York in the case of the Niagara & Lake Erie Power Company. The power company appealed from a decision of the commission, and the matter in question concerned the interpretation of "town authorities" cited in the law. Justice Howard holds that this term applies to town boards and not to superintendents of highways.

All-Metal Conduit in Louisville After May 1.—All-metal conduit installations will be the order in Louisville, Ky., after May 1. It had been provided that the new regulations were to go into effect on July 1, but the date has been moved forward at the instance of the contractors themselves. This action was taken in part on account of the alleged fact that solicitors had been urging Louisville property owners to let their contracts before Feb. 1, since contracts for wiring let after that time would represent a marked advance. The former rule provided that contracts signed before Feb. 1 might be carried out under the old regulations. The new order makes no exemptions.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

December Exports of Copper Near Record.—The exports of copper in December amounted to 42,426 tons. This figure was exceeded only in March, 1913, when the exports of copper were 42,428 tons.

National Safety-First Exhibit.—There will be held in Washington during the week of Feb. 21 a "safety-first" exhibit in which all of the government departments are taking an active part. This exhibit will take on a national aspect, as manufacturers and operators from all over the country are invited to be present in order that they may see what the government of the United States is doing in "safety-first" work.

New Type of Apparatus Necessary for Larger Increase of Railroad Electrification.—Electric traction cannot supersede steam traction for all or even a large part of the railway mileage of the country, according to George Gibbs, chief engineer of electric traction for the Long Island Railroad, unless some radically new type of apparatus should be developed, a contingency which, he thinks, does not seem at present to be pending.

Changes Made in Offices of Wisconsin-Minnesota Light & Power Company.—Some changes have just been made in the offices of the Wisconsin-Minnesota Light & Power Company which include the elimination of the Eau Claire department of engineering, the affairs of which will be handled by the Kelsey-Brewer Company at Grand Rapids, and a consolidation of the power-plant and transmission operations, and such engineering as is not done by the Kelsey-Brewer Company will be under the supervision of G. W. McIver, Jr., at the general offices in Eau Claire. Hereafter the purchasing of supplies will be looked after by each district manager instead of by a special central department.

Coal Consumption per Kilowatt-hour.—The average coal consumption per kilowatt-hour for thirty corporations generating electricity largely by steam power in New York State in 1914 and having a gross revenue of over $25,000 per annum was 4.44 lb. This compares with 4.90 lb. in 1913, 5.03 lb. in 1912, and 4.82 lb. in 1911. The consumption for seven companies generating largely from water-power in 1914 was 4.46 lb. of coal per kilowatt-hour generated by steam; in 1913 it was 5.26 lb., in 1912 6.11 lb., and in 1911 8.72 lb. In the case of twelve companies that purchased over half of their output, the coal consumption in 1914 was 5.78 lb. per kilowatt-hour generated from steam; in 1913 it was 6.13 lb., in 1912 8.65 lb., and in 1911 9.55 lb.

Seven Years' Franchise Life in London.—Franchises to operate private light and power plants in London are limited to seven years and are extended usually for periods of seven years.

Electrolytic-Copper Refining Capacity Almost Two Billion Pounds per Annum.—Excluding the small capacity for refining Lake copper, the electrolytic-copper refining capacity of the United States at the end of 1915 was 1,827,000,000 lb. per annum.

More Than 400 Electric Locomotives Ordered in Last Five Years.—During the last five years the number of electric locomotives built amounted to 430. One hundred and thirty-three were ordered in 1911, seventy-five in 1912, ninety-four in 1913, fifty-nine in 1914 and sixty-nine in 1915.

College Graduates to Build Up Foreign Trade.—The American International Corporation, the new fifty-million-dollar corporation to promote foreign trade, purposes to employ a large number of young men, most of whom will be selected from college graduates, and to educate them for permanent positions in the foreign field.

More Cables Across San Francisco Bay.—The Great Western Power Company has been granted permission by the California Railroad Commission to lay a third cable across San Francisco Bay for $150,000 and a fourth cable for $100,000. At the same time the company was authorized to build a transmission line from South Bend to Oakland.

Engineering Students Deliver Lectures to Electricians.—A series of technical lectures by seniors of the electrical engineering department of the State University of Washington have been arranged to be given before the Electrical Workers' Union of Seattle. The first lecture was by E. C. Miller on "Elementary Electricity" and the second by R. S. Gillett on "Ohm's Law and Simple Direct-Current Circuits."

Important Change in Wiring Code.—The Department of Gas and Electricity of the city of Chicago has issued a notice calling attention to the fact that the new code rule on rubber-covered wire will go into effect on Feb. 15, 1916. This rule permits the use of single-braid wire, in sizes from No. 14 to No. 8 inclusive, in conduit on all installations on and after Feb. 15. Formerly all wire regardless of the size had to carry a double braid to pass inspection if it was installed in conduit.

Alternating Current Coming More Into Use for Steam-Road Signaling.—In discussing the progress of signaling for railroads during 1915 W. J. Eck, president of the Railway Signal Association, said that the most marked tendency of the year has been the very extensive use of alternating current for the operation of signals on steam railways. First employed on electrified lines from necessity, its advantages were so apparent that its use has rapidly extended to steam-railroad lines, and the coming years, Mr. Eck thinks, will probably see the employment of alternating current with the majority of semaphore signals installed.

Horse Trucks Equipped with Electrically Driven Advertising Signs.—Seventy-five of the horse-drawn trucks of the American Sugar Refining Company of New York are equipped with electrically driven signs advertising the company's products. A 6-volt, 60-watt motor supplied by a 120-amp.-hr. storage battery furnishes the motive power.

Cincinnati Valuation Testimony Completed.—The Ohio commission has completed taking testimony in the case of Cincinnati against the Union Gas & Electric Company on Jan. 19, and the attorneys have until Feb. 10 to present briefs, after which oral arguments will be heard and the commission will fix the final valuation upon which a rate for service will be based.

No Reduction in Rates for County in Consideration of Right-of-Way.—Judge Clifford of the Pierce County Superior Court recently ruled that no reduced rates on electricity can be given by the Tacoma (Wash.) municipal plant to Pierce County. The decision sustains the contention of the city that under the public service act all consumers of energy under similar conditions must pay the same rate, even though some of the users are municipal corporations like the county or school district. The county's defense was that the city agreed to give the county a low rate in consideration of right-of-way for power lines through the county.

New Standard-Price Bill.—Under the title "To protect the public against dishonest advertising and false pretenses in merchandising," Representative Dan V. Stephens of Nebraska has reintroduced in the House of Representatives the original Stevens-Ayres bill with a number of important amendments designed to meet the views of many friends of the measure. The new bill specifically permits discounts for cash and for quantity and for allowances and rates covering costs of transportation. A final, new paragraph exempts sales to libraries and other public institutions. There are also drastic provisions against the use of the privileges of the bill in connection with any monopolized product or one concerning which there is any combination between makers.

Reduction of Gas Pressure Increases Sales of Electrical Appliances in Kansas City.—Nearly 1000 electric grills, several hundred irons and many tailors' irons, besides several radiators and similar devices, were sold in January by the Kansas City Electric Light Company. The dropping of the temperature to 14 deg. below zero resulted in the reduction of gas pressure to the point where on several mornings in thousands of homes water could not be boiled or toast made. The light company, in its advertising this winter, had been emphasizing the dependability of electric light in the coldest weather, and public thought was ready to turn to electricity for cooking and heating as well as for lighting. In its display window the company showed many devices useful for getting light meals, ribbons being run from the articles to legends on the window denoting their purposes.

United States Leads World in Number of Electrical Steel Furnaces.—With seventy-three electrical steel furnaces in operation at the end of 1915, thirty-two of which were constructed during the year, the United States has passed Germany, which had led the world in the number of electrical steel furnaces since 1910. Three hundred and three electrical steel furnaces is the estimate of the world's total.

Reading Transit & Light Exempted from Workmen's Insurance.—The Reading Transit & Light Company has been advised by the Workmen's Compensation Board of Pennsylvania that it has been granted exemption from insurance under the workmen's compensation act of 1915. One factor which influenced the board in granting this exemption was the comparative freedom from accidents to employees of the corporation.

Utilities in Kentucky Town Must Paint Poles.—City authorities of Mayfield, Ky., are undertaking to compel the pole-using utilities operating in that community to paint their poles and have served notice to that effect. A fine of $100 has been assessed against a telephone company and will serve as a test case. The city ordinance provides that each pole unpainted for a week shall constitute a separate offense and subject the owner to a fine of $10.

Latitude and the Varying Value of the Horsepower.—A table prepared by the Bureau of Standards, Washington, D. C., indicates that the variation with latitude of the locally defined horsepower reaches a value as high as 0.6 per cent. It has therefore been recommended that the value of the English and American horsepower be recognized as 746 watts (or 550 foot-pounds per second at 50 deg. latitude at sea level, approximately the latitude of London), the value in foot-pounds per second being computed from the above for other latitudes. The continental horsepower is correspondingly taken uniformly as 736 watts (or 75 kilogram-meters per second at north latitude 52 deg. 30 min., the position of Berlin).

Potential Water-Power of the United States.—Recent hearings before the public lands committee of the House of Representatives disclosed that various estimates have been made as to the amount of undeveloped potential water-power in the United States. Most careful estimates indicate the potential horsepower in the United States as ranging from 28,000,000 to 35,000,000. The government has made an estimate on a basis of 28,000,000 potential horsepower in the United States and has divided it into groups and states as follows: North Atlantic States, 2,200,000 hp., or 7.9 per cent; South Atlantic States, 2,300,000 hp., or 8.2 per cent; the North Central States, 1,700,000 hp., or 6 per cent; the South Central States, 1,500,000 hp., or 5.3 per cent; the Western States, 20,400,000 hp., or 72.6 per cent. This includes the potential horsepower for navigable streams as well as non-navigable streams.

Mayor Keeps City Streets Dark.—Efforts of the City Council of Princeton, Ky., to pass an electric-lighting measure over the veto of Mayor Lisanby have been forestalled by the Mayor, who refuses to entertain a motion to such effect. The city's streets have been dark for a year as a result of a difference with the local lighting company.

Valuation of New York City Franchises Almost Half a Billion.—The New York State Tax Commission has announced that the special franchise valuation of corporations in New York City amounts to $455,883,400. This is the largest valuation ever placed on the city's utilities. The increase over the 1915 valuation amounts to $41,970,700.

Steel Tower Resists Land Slides.—An interesting instance showing the stability of heavy, well-proportioned square-base steel towers, properly installed, is furnished by F. G. Allen, secretary to C. O. Lenz, consulting engineer, New York. A tower which is one of a main line of the Virginia Power Company from its Cabin Creek steam station, carrying six No. 000 copper conductors of two 44,000-volt circuits, stood in an upright position after a landslide had carried it some 50 ft. down a steep incline.

Civil Service Examination for Junior Mechanical or Electrical Engineer.—The United States Civil Service Commission invites attention to the fact that in the open competitive examination for junior mechanical or electrical engineer, engineer department at large, to be held on March 15-16, 1916, students in mechanical or electrical engineering in colleges or universities of recognized standing who expect to be graduated not later than June, 1916, will be admitted if otherwise eligible, but the names of such students will not be certified for appointment in the event that they attain eligibility in the examination until they have furnished proof of graduation.

"Nickel Plate" Railroad Will Use Electricity for Moving Dirt.—The "Nickel Plate" Railroad has signed a contract with the municipal plant at Cleveland, Ohio, for energy with which to operate centrifugal pumps for moving dirt in its crossing-elimination work in that city. This will amount to about $50,000 a year to the city plant while the work continues. Four 12-in. centrifugal dredge pumps, each with a capacity of about 4000 gal. of water per minute, will be directly connected with variable-speed motors of about 250 hp. These pumps are expected to handle all kinds of earth and stones up to 6 in. in diameter. The impellers will operate at about 500 r.p.m. and will be capable of lifting by suction from a depth of 12 ft. water carrying as much as 35 per cent of dirt. Pumps will be installed along the excavation for a distance of two and a half miles and will be connected by 12-in. steel pipe. They will pump the earth-laden water from one to another and finally empty it into Walworth run, where the water will be carried off by that stream and the dirt be left for filling purposes.

Los Angeles Jovian League.—H. L. Carnahan, Commissioner of Corporations of California, spoke at the Jan. 19 meeting of the Los Angeles Jovian League on the topic "A Year of the Blue-Sky Law."

New York Section, E. V. A. — Day Baker, manager of agencies of the General Vehicle Company of Long Island City, spoke on sales problems before the New York Section of the Electric Vehicle Association on Jan. 25.

Pittsburgh Section, I. E. S.—A paper entitled "The Laws of Reflection and Transmission of Light" was presented by T. W. Rolph before the Pittsburgh Section of the Illuminating Engineering Society at its meeting on Jan. 21.

Buffalo Section, N. E. L. A.—A. A. Landon, vice-president and general manager of the American Radiator Company, addressed the Buffalo branch of the National Electric Light Association on Jan. 11 on the subject of "Preparedness."

Detroit Engineering Society.—The next meeting of the Detroit Engineering Society will be held on Feb. 4, 1916, at the society's hall. Walter N. Crafts, consulting engineer, Oberlin, Ohio, will speak on "Recent Developments of the Electric Furnace."

New York Electrical Society.—The 343d meeting of the New York Electrical Society was held in the Engineering Societies Building, New York City, on Jan. 27, 1916. Dr. Michael I. Pupin gave an address on "Wireless Transmission Problems."

Schenectady Section, A. I. E. E.—The 167th meeting of the Schenectady Section of the American Institute of Electrical Engineers was held on Jan. 18. Elmer A. Sperry presented an illustrated paper entitled "The Electrically Driven Gyroscope and Its Uses."

Lynn Section, A. I. E. E.—The Lynn Section of the American Institute of Electrical Engineers held its annual banquet at the Boston City Club rooms on Jan. 22. O. T. Crosby of Washington, D. C., a retired military officer, spoke on "An Armed Tribunal and Preparedness."

Poughkeepsie Electrical Contractors' Association.—The following officers have been elected by the Electrical Contractors' Association of Poughkeepsie, N. Y., to serve for 1916: President, E. S. Pickenpack; vice-president, Joseph Quinn; secretary, A. Smith, and treasurer, L. Jaminet.

Cohasset (Mass.) Electric Club.—The Cohasset Electric Club has elected the following officers to serve for 1916: Paul Gilman, president; Harold Brown, vice-president; Anselm Beal, secretary and treasurer. A question box department has recently been created and placed in charge of George Jason, Jr.

Association of Engineering Societies.—The Association of Engineering Societies has disbanded, and with the December number of the *Journal*, which completed the fifty-fifth volume, the association went out of existence. This action was brought about by the desire on the part of member societies to publish journals of their own.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Ohio Society of Mechanical, Electrical and Steam Engineers.—The next meeting of this society will be held in Cleveland, Ohio, June 15 and 16. The president for the coming year is Joseph L. Skeldon of Toledo, and the secretary-treasurer is Frank E. Sanborn, Ohio State University, Columbus, Ohio.

Dayton Jovian League.—Members of the Dayton Jovian League were joined by 100 members of the order from Cincinnati, Columbus, Indianapolis, Toledo and other towns at a banquet at the Miami Hotel on Jan. 20. This was intended as a "get-together" session during the Dayton Industrial Exposition, which the Jovians attended in a body.

Minnesota Electrical Association.—The Minnesota Electrical Association will hold its annual meeting at the Radisson Hotel, Minneapolis, Minn., on Tuesday and Wednesday, March 21 and 22. T. D. Crocker of Minneapolis is president of the association and F. A. Otto of the electrical department of the St. Paul Gas Light Company is secretary.

Pittsfield Section, A. I. E. E.—Giuseppe Faccioli of the Pittsfield Works of the General Electric Company spoke before the Pittsfield (Mass.) Section of the American Institute of Electrical Engineers on Jan. 13 on "Power Transformers and Transmission Lines." At the meeting on Jan. 20 A. R. Smith of Schenectady lectured on "Substations and Their Equipment."

Schenectady Section, A. I. E. E.—A special meeting of the Schenectady Section of the American Institute of Electrical Engineers was held at Edison Club Hall on Jan. 25, when R. J. McClelland, chief engineer of the Electric Bond & Share Company, gave an illustrated lecture on the "Physical Development of a Large Western Hydroelectric Transmission System."

Philadelphia Section, I. E. S.—At the meeting of the Philadelphia Section of the Illuminating Engineering Society held at the Engineers' Club on Jan. 21 two papers were presented, one on "Lighting Legislation," by L. B. Marks, consulting engineer, and the other on "The Work of the Lighting Service Department of the Philadelphia Electric Company," by G. Bertram Regar.

Attendance at Electric Club-Jovian League of Chicago.—During the last year the Electric Club of Chicago, which about midyear was amalgamated with the local Jovian League, held thirty-nine regular monthly meetings, at which the average attendance was 148. The largest meeting was the one held on Oct. 26, at which Dr. C. P. Steinmetz of the General Electric Company addressed the club.

Pittsburgh Section, A. I. E. E.—The January meeting of the Pittsburgh Section of the American Institute of Electrical Engineers was held at the Carnegie Institute of Technology on Jan. 11. Prof. Arthur F. Van Dyck presented a paper on "Recent Progress in Radiotelegraphy." A demonstration was given of the recently installed radio station at the Carnegie Institute of Technology.

Dallas (Tex.) Electric Club.—The following have been elected to serve as officers of the Dallas Electric Club for 1916: H. C. Bramley, president; C. E. Calder, first vice-president; Mac Sterrett, second vice-president; Henry Lange, third vice-president; J. H. Moseley, secretary-treasurer, and O. T. Hazelton, assistant secretary-treasurer. The club held an inaugural ball at the Adolphus Hotel on Jan. 14 for the new president.

Illinois State Electric Association Convention.—J. J. Frey, president and manager of the Southern Illinois Light & Power Company, has been appointed by the executive committee of the Illinois State Electric Association to arrange for a convention to be held at Champaign, Ill., on Feb. 23 and 24. E. MacDonald, Lincoln, Ill., is president of the association; H. E. Chubbuck, Peoria, Ill., is secretary, and A. G. Miller, Hillsboro, Ill., is assistant secretary.

Institute of Radio Engineers.—A meeting of the Institute of Radio Engineers was held on Jan. 5 at Fayerweather Hall, Columbia University, New York City, when a paper on "Variations in Nocturnal Transmission," by Prof. A. H. Taylor and A. S. Blatterman, was presented. This paper gave an interesting account of experiments in nocturnal transmission which have been carried on between the University of North Dakota and Washington University in St. Louis, Mo.

American Society of Heating and Ventilating Engineers.—The annual meeting of the American Society of Heating & Ventilating Engineers was held at the Engineering Societies Building, New York, on Jan. 18, 19 and 20, when a comprehensive entertainment and business program was carried out. The officers elected to serve for the ensuing year are: President, H. M. Hart; first vice-president, F. P. Chapman; second vice-president, A. K. Ohmes; secretary, J. J. Blackmore, and treasurer, Homer Addams.

Joint Meeting of Iowa Public Utility Associations.—It has been voted to hold a joint convention of the Iowa Electric Light Association, the Iowa Street Railway and Interurban Association and the Iowa, Nebraska and South Dakota Gas Association at Dubuque, Iowa, during the second week in May, 1916. This will be the first joint meeting of the three organizations, and a gas and electric show will be held in connection therewith. The executive members of these associations have adopted resolutions commending closer co-operation between the college and public-utility companies in the matter of technical investigations.

Association of Iron and Steel Electrical Engineers.—The 1916 convention of the Association of Iron and Steel Electrical Engineers will be held in Chicago, Sept. 18-22 inclusive. W. O. Oschmann of the Oliver Iron & Steel Company, Pittsburgh, Pa., is secretary.

American Wood Preservers' Association Convention.—At the annual meeting of the American Wood Preservers' Association, which was held at Chicago Jan. 18, 19 and 20, the program was replete with papers showing results of tests on treated paving blocks, bridge and structural timbers and cross-ties. Very little attention was given to treating poles or cross-arms. The officers of the association elected for the ensuing year are as follows: President, Carl G. Crawford, general manager of the American Creosoting Company, Louisville, Ky.; first vice-president, John Foley, chief forester of the Pennsylvania Railroad Company, Philadelphia; second vice-president, Morris K. Trumbull, vice-president of the National Lumber & Creosoting Company, Kansas City, Mo.; secretary-treasurer, F. J. Angier, superintendent of timber preservation for the Baltimore & Ohio Railroad, Baltimore; members of the executive committee, F. S. Pooler, Chicago, Milwaukee & St. Paul Railroad, and A. R. Joyce, Joyce-Watkins Company, Chicago.

Boston Section, A. I. E. E.—Seven hundred persons attended a meeting of the Boston Section of the American Institute of Electrical Engineers at the Franklin Union, Boston, Mass., on Jan. 14, at which a demonstration of the oscillograph was made in connection with a Boston-San Francisco telephone talk. C. L. Dawes, an instructor at Franklin Union, and H. S. Crane of Harvard University lectured upon the functions and construction of the instrument, and R. W. Hicks of the American Telephone & Telegraph Company, New York, conducted the telephone demonstration. Dr. M. I. Pupin, inventor of the loading coil, and Chief Engineer John J. Carty of the American company, president of the Institute, addressed the gathering from New York, and H. G. Bates, commercial representative of the Pacific Telephone & Telegraph Company, was in charge of the San Francisco end of the affair. Owing to a blizzard west of Reno, Nev., the line had to be looped 1500 miles further through Portland, Ore., but the demonstration was entirely successful notwithstanding this condition.

California Electrical Contractors, Dealers and Jobbers.—The regular meeting of the California Association of Electrical Contractors and Dealers was held at the Palace Hotel in San Francisco on Jan. 21. The final report of the retiring secretary, W. H. Hanbridge, was read and accepted. In accepting the resignation of L. R. Boynton, one of the oldest members, it was voted that he be made an honorary member of the association, the first time this honor has been conferred. The meeting was followed by a banquet, which was attended by the jobbers as well as contractors and dealers. Among the after-dinner speakers were W. H. Holabird, San Francisco, Holabird-Reynolds Company; Frank Summers, San José, Century Electric Company, and H. B. Farquarson, San Francisco, Building Trades Employers' Association. In recognition of the retiring secretary's many years of service, the association presented him with a handsome solid silver tea and coffee service. G. A. Cleary, San Francisco, Board of Fire Underwriters of the Pacific, reviewed the changes in wiring regulations which appear in the new 1915 code, and S. J. Lisberger, San Francisco, Pacific Gas & Electric Company, gave a talk on the laying of the Golden Gate submarine cable, illustrated with slides and moving pictures.

Indiana Engineering Society.—The annual meeting of the Indiana Engineering Society will be held at the Claypool Hotel, Indianapolis, on Feb. 3, 4 and 5. The morning sessions of Feb. 3 and 5 will appeal more particularly to the electrical interests. The program for the Friday morning session includes the presentation of the following papers: "Efficiency in the Utility Plant," by Charles Brossmann, consulting engineer, Indianapolis; "Municipal Ownership, Yes or No," by F. F. Chandler of the Chandler & Taylor Company, Indianapolis; "Method of Measuring Consumers' Electric Demand," by E. T. Selig, United Gas & Electric Engineering Corporation, New York City; "Handling Coal by the Car-Dump Method," by Scott W. Linn, president of the Cavanaugh-Leim Company, Cleveland, Ohio, and "Efficiency of Hand-Fired Furnaces," by E. B. Smith, Marion (Ind.) Machine & Foundry Company. On Saturday morning C. F. Harding, professor of electrical engineering at Purdue University, will present a paper on "Testing High-Voltage Insulators." The remainder of the program of this session includes, among other reports and papers, the reports of the committees on electrical engineering, central-station lighting and power, electrical railroads, and mechanical engineering.

Wisconsin Contractors Meet.—At the thirteenth annual meeting of the Electrical Contractors' Association of Wisconsin, held in Milwaukee, Jan. 17 and 18, the following officers were elected for the ensuing year: President, F. J. Natwick, Natwick Electric Company, Grand Rapids; vice-president, Paul Honola, Honola Electric Company, Sheboygan; treasurer, George Knoerr, Knoerr & Fischer, Milwaukee; secretary, Albert Petermann, Milwaukee. B. L. Burdick of the Burdick Electric Company, Milwaukee, was elected a director for a three-year term of office, and W. R. Johnson of Wausau and Paul F. Harloff of Madison hold over as directors for two years and one year respectively. Herman Andrae of the Herman Andrae Electrical Company, Milwaukee, was elected a director of the National Electrical Contractors' Association. The program of the convention was as follows: "Enforcing the Code," by B. Berssenbrugge, electrical inspector for the city of Milwaukee; "The Contractor as a Dealer," by B. L. Burdick, Burdick Electric Company, Milwaukee; "Liability Insurance," by H. L. Geisler of Geisler, Neckerman & Bullock, Madison; "The Manufacture of Dry Batteries," by Prof. Charles F. Burgess, French Carbon & Battery Company, Madison; "Remote Control of Electrical Apparatus," by L. L. Tatum, Cutler-Hammer Manufacturing Company, Milwaukee; "Storage Batteries," by L. F. Meissner, Jr., Edison Storage Battery Company, Chicago, and "Manufacture of Rubber-Insulated Wires and Cables," by Henry A. Morss, vice-president Simplex Wire & Cable Company.

Electrical Section, Western Society of Engineers.—The officers of the electrical section of the Western Society of Engineers elected to serve for the ensuing year are as follows: Chairman, C. A. Keller; vice-chairman, William J. Crumpton, and trustee, Edward N. Lake.

Milwaukee Engineers' Society.—The Engineers' Society of Milwaukee met on Jan. 12 for a public discussion of the engineering questions in connection with the plans for a new street-lighting system for the city. Frank A. Vaughn of Vaughn, Meyer & Sweet of Milwaukee, who prepared the plans, gave an illustrated talk on the subject, "Should the City of Milwaukee Own Its Street-Lighting System?" S. B. Way, general manager of the Milwaukee Electric Railway & Light Company, A. J. Sweet and J. R. Cravath of Chicago discussed the topic.

Western New England Section, National Association of Electrical Inspectors.—Representatives of the Connecticut Electrical Contractors' Association and the Massachusetts Electrical Contractors' Association and Connecticut members of the National Electric Light Association attended the annual meeting of the Western New England Section of the National Association of Electrical Inspectors, held in Hartford, Conn., on Jan. 12. The meeting was divided into two sessions. At the opening meeting in the afternoon members of the American Insurance Institute were invited to be present. During the morning session questions on standards for electrical wiring were discussed. In the afternoon Past-president Thomas H. Day of Hartford read a paper on "Concentric Wiring." Samples of fittings and pictures secured from England illustrated Mr. Day's talk, contrasting American and English standards. In order to secure first-hand information Mr. Day corresponded with a number of leading authorities on the subject in England. It was the opinion of the experts in that country that increase in new connections was greatly restricted by the cost of wiring. Officers for the ensuing year were elected as follows: President, A. W. Hopkins, of Springfield, Mass.; vice-president, L. N. Heebner, of South Manchester, Conn.; secretary and treasurer, R. J. Forsyth, of Greenfield, Mass.; executive committee, Arthur H. Soper, chairman, Hartford; M. H. Mahoney, Turners Falls, Mass.; George S. Pitt, Middletown, Conn.; P. O. Neumann, Holyoke, Mass.; F. A. Whiting, Canaan, Conn.

FINANCE, COMMERCE AND INDUSTRY

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Manufacturing and Industrial

Prosperity in Steam-Turbine Industry

Manufacturers of steam turbines, both large and small, without exception report a larger volume of business than has ever before been obtained. Factories are rushed and are working night and day. In the case of the large central-station units the production for 1916 has already been contracted for, while the factory capacity for manufacturing small units is taken care of up to the fall.

It was the opinion of all of the manufacturers interviewed that the prosperity of the trade, which began about four or five months ago, could not be traced to war orders. The volume of buying is rather an indication of the wave of prosperity which is creeping over the industrial business of the country. Orders have been received from every conceivable industry that could use steam turbines, indicating that the period of industrial depreciation and curtailment of expenditure for additions and improvements has come to an end. Some of the units have naturally found their way into those factories working exclusively on the manufacture of war munitions, but by far the greater part of the orders have come from industries neither directly nor indirectly connected with such activities. Furthermore, it is not thought that the present buying is a flash in the pan incited by an inflated conception of the present industrial situation. In the small-turbine business it was the consensus of opinion that the present volume of buying would not be restricted to any appreciable amount for some time. The manufacturers anticipate during the coming months an extraordinarily good demand for steam turbines. The demand for large steam turbines, for use particularly in central stations, is of such a fluctuating nature that no prediction whatever for the future is made.

Another feature which is influencing the present market and which will influence the future market to a considerable degree is the introduction of the reduction gear. By the use of reduction gears it is possible to use the steam turbine both economically and efficiently for low-speed work. Steam turbines in small units for compact isolated plants thus become direct competitors of motor-generators, small low-speed engines and electric motors.

Owing to the slow delivery of raw materials, the promised delivery on steam turbines has been advanced in the case of small turbines about two to three or more months. It was also found that actual deliveries were being delayed at the present time owing to a shortage of labor and to the freight congestion. Advancing wages, however, are relieving the labor situation, and the freight situation is receiving the active attention of railroad officials. As soon as it is cleared up, of course, better deliveries can be had. Only this week it was announced that the New Haven line had lifted its embargo on freight consigned via steamship routes. This will not only help those manufacturers whose plants are in the New England States but will help materially to relieve the situation at the western terminals of this road's lines, in that way helping to a certain extent manufacturers in every section of the country.

Manufacturers have been forced to advance steam-turbine prices. Production costs had increased to such an extent that it was not possible to maintain the former scale of prices.

While during the preceding two or three years of industrial inactivity long-stretched-out credits were given where necessary to procure the order, it is now the practice to accept no orders for long credits. Collections are therefore excellent.

When asked what effect the introduction of high-pressure boilers would have on the steam-turbine business, the manufacturers said that the effect, if any, would be beneficial. Certain changes would have to be made, but it was expected that the result would be a more efficient and economical unit that would cause an increase of sales.

As an indication of the future, it was pointed out that one of the first steps necessary toward largely increasing the steam-turbine business will be standardization of smaller units. By standardization it will be possible to relieve the present sale of turbines from its technical atmosphere and put it on a merchandising plane. While nothing definite has been done in this direction so far, it is felt that this action is not distant.

The Berton Elliot Publicity Service, Illuminating Building, Cleveland, Ohio, technical advertising agent, is the successor to the Elliot & Ball Company. The new concern is in charge of Berton Elliot.

Angus S. Hibbard has announced that, in addition to his activities with the Chicago Telephone Company, of which he has been general manager for the past eighteen years, he is prepared to act as consulting engineer for organizations desiring advice concerning commercial and technical business organization.

W. B. Pierce, who for several years has been employed in the domestic-appliance department of the Western Electric Company, has accepted a position with the Hughes Electric Heating Company. Mr. Pierce will have charge of sales work for the Hughes company in the New England States and will make his headquarters in Boston, Mass.

Engineering Publicity.—Walter B. Snow and staff, advertising agents and publicity engineers, Boston, Mass., have added to their organization Charles W. Burrage, formerly of the instruction staff of the Massachusetts Institute of Technology and later associated with the F. W. Dodge Company in connection with the preparation of Sweet's Index.

Graphic Instrument Business Growing Continually.—H. T. Glover, sales manager of the Esterline Company, Indianapolis, Ind., reports that in the field covered by his company business conditions are very bright. The business in graphic meters is growing continually. During December, 1915, shipments of graphic instruments were made to more than fifty different companies.

Inspection of South American Shipments.—Edwin G. Hatch, consulting engineer, Equitable Building, New York City, has recently inspected and shipped electrical apparatus furnished by the Westinghouse and General Electric companies, R. Thomas & Sons Company, Milliken Brothers, Inc.; Hotpoint Electric Heating Company, etc., to South Africa and China. Mr. Hatch is giving special attention during the war to these foreign shipments.

Pittsfield Plant of General Electric Company Busy.—Business at the Pittsfield (Mass.) works of the General Electric Company, it is reported, is ten times better than it was at this time last year. More employees are being taken on the company's force at this place, 100 being added last week to the working staff, which is now said to number over 4500. The plant is being worked day and night. Recently night workers were granted a 5 per cent increase in pay, it is stated, and shorter hours.

Errors in Government Trade Statistics.—According to a special committee of the Chamber of Commerce of the United States, the trade statistics compiled by the federal government are full of inaccuracies. According to the

chairman of the committee. "Because of the obsolete methods under which our custom house officials are obliged to obtain their data relating to exports, cargoes whose values run into thousands of dollars on single vessels leave our port without being recorded in our statistics of export."

The Edison Storage Battery Company, Orange, N. J., has appointed Paul Sutcliffe advertising manager. Mr. Sutcliffe got his earlier advertising and selling experience in California. On coming east in 1912 he joined the Edison company, but resigned at the end of a year to become secretary of the W. S. Hill Advertising Company, Pittsburgh, Pa. For the past year he has been in the advertising department of the Edison Storage Battery Company.

Diehl Motor Plant Leased.—The Diehl Manufacturing Company has leased its plant on Newark Avenue, Elizabeth, N. J., to Woodward & Company, Inc., a Philadelphia concern. The Woodward company has also purchased all of the machinery, equipment and accessories of the plant, valued at $300,000. The lease is for one year and the rental is $25,000. Since 1896 the Diehl company has been engaged in the manufacture of electric motors and has furnished employment to 500 men.

Gasoline Trucks for Central-Station Service.—The Packard Motor Car Company, Detroit, has developed a gasoline motor truck which it recommends particularly for central-station delivery work. The truck is being built in two sizes, one ranging in capacity of from 1 ton to 1.25 tons, the other from 1 ton to 1.5 tons. The trucks are designed for carrying the loads at relatively high speeds and from this point of view have been designed to have a short turning radius and centralized control.

The American Insulating Machinery Company, Fairhill and Huntingdon Streets, Philadelphia, Pa., has recently been incorporated under the laws of the State of Pennsylvania. R. W. Withington has been elected president, and H. L. Benner secretary and treasurer. The business of the firm dates back to 1855, at which time it was established by Ralph Withington, the grandfather of the present president of the company. The company is not only manufacturing a large amount of wire-insulating machinery, wire-enameling machinery, etc., for domestic distribution, but is also producing considerable material for export. For this reason the company has just prepared a general catalog of its products, which is printed in English, French, German and Spanish.

Factory Appliance Company.—Arrangements have recently been made so that the Factory Appliance Company, Illuminating Building, Cleveland, Ohio, will have charge of all purchases made in this country by the Consortium d'Importateurs et Exportateurs, Paris, France, the commercial department of the Banque Mutuelle d'Etude, 8 Rue Nouvelle, Paris. The Consortium d'Importateurs et Exportateurs has a listed capital of 2,000,000 francs and is carrying on extensive engineering and development work throughout France. The above-named concern is especially interested in electric power and lighting supplies, instruments, insulated and bare wire, lamps, batteries, etc. The Factory Appliance Company is desirous of getting in touch with manufacturers who want to make permanent business connections in France.

Electric Equipment for Gasoline Automobiles.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports the receipt of the following recent contracts for automobile equipment: The Gerlinger Motor Car Company, Portland, Ore., for its No. 750 starting motor with outboard "Bendix" gear shift and its No. 400 generator unit with six-cylinder vertical ignition; the Martin Carriage Company, York, Pa., for its No. 507 starting motor with six-cylinder vertical ignition set and its No. 208 lighting generator; the Stegeman Motor Car Company, Milwaukee, Wis., for its No. 318 starting motor with out-board "Bendix" transmission and its No. 240 ignition and lighting generator. The Westinghouse company reports that during the month of December, 1915, its automobile equipment works produced 200 per cent more equipment than in the corresponding month of the previous year. This production was also 30 per cent in excess of that of the preceding month, November, 1915. Anticipating continued increase in production, the company has made provision to meet a continued increase of 25 per cent each month, which is expected for several months to come.

Recent Orders for Oil Engines.—The August Mietz Machine Works, 125 Mott Street, New York, manufacturers of two-stroke-cycle oil engines, have recently received the following orders for their M. & W. engines: Melchior, Armstrong & Dessau, New York, a 30-hp. and a 45-hp. engine; the Wayne Cold Storage Company, East Williamson, N. Y., an 80-hp. engine; the Dill Machine Company, Philadelphia, Pa., a 50-hp. engine; the American Steamship Line, New York, two 35-hp. engines to be directly connected to generator sets; the American Mineral Company, Johnson, Vt., a 100-hp. engine to be installed in a plant where an M. & W. 80-hp. engine is already in operation; the Atlantic Fruit Company, New York, a 12-hp. engine for operating a generator set; the Pennsylvania Railroad Company, Altoona, Pa., eight 40-hp. engines to be directly connected to generators; the Shipley Construction & Supply Company, Brooklyn, N. Y., three 50-hp. engines; Baer Brothers, Stamford, Conn., one 150-hp. engine, making the second unit of the same size added to the plant; the McCreery Machinery Company, Seattle, Wash., two 150-hp. engines; Swayne & Hoyt, San Francisco, Cal., one 200-hp. engine; the Harding Creamery Company, Omaha, Neb., one 150-hp. engine; the Hind Steel & Wire Works, Huntington, L. I., a 50-hp. engine, making two units in this plant; the American Trading Company, New York, one 30-hp. engine, and Albert R. Reynolds, Silver Lake, N. H., one 50-hp. engine.

Western Electric Company Launches Extensive Fan-Selling Campaign. — More people naturally can afford to pay $5.95 for an electric fan than $10 or $12. A good fan selling for this price consequently should have a wide market and meet a waiting demand for electric fans among customers who have before wanted a fan but thought the price to be too high. The Western Electric Company, 463 West Street, New York, has developed a well-rounded campaign for putting such a fan at this price on the market. The company believes the fan will appeal particularly to dealers not only because the machine itself is well made and attractive but because it has planned a special publicity campaign to educate the public as to the desirability of all electric fans, and this fan in particular. The fan weighs but 5 lb. and is 8.75 in. high with a blade diameter of 6 in. It will sell for $5.95 and is known as the "Western Electric Six." The fan gives a steady breeze, it is asserted, and furnishes it quietly. It is equipped with a universal motor that runs equally well on alternating current or direct current at a very small consumption. The frame and base are in one piece and finished a dull black, making the fan substantially compact and pleasing to the eye. The blades, protected by a guard securely fastened to the frame, are of polished brass. The fan is furnished with cord and plug. The Western Electric Company has worked out a special advertising campaign to dispose of this fan and is offering a comprehensive set of sales helps for the dealer. Those helps include newspaper electrotypes, lantern slides, window displays and circular matter. The fans come in individual cartons and are packed in case lots of ten. The dealer can secure less than case lots, but gains a special discount by purchasing his stock in lots of ten or more.

NEW YORK METAL MARKET PRICES

	Jan. 18 Selling Prices Bid	Jan. 18 Selling Prices Asked	Jan. 25 Selling Prices Bid	Jan. 25 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	85 15 0		91 5 0	
Prime Lake	23.75	to 24.00†	25.00	to 25.50†
Electrolytic	23.75	to 24.00†	25.00	to 25.50†
Casting	22.75	to 23.00†	24.00	to 24.25†
Copper wire base	25.00	to 25.50†	26.00	to 26.50
Lead	5.80		6.10	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	23.00†		23.00†	
Spelter	18.42½		19.17½	to 19.42½
Tin, Straits	40.87½		42.12½	
Aluminum, 98 to 99 per cent.	51.00	to 53.00	51.00	to 53.00

OLD METALS

Heavy copper and wire	18.00	to 18.50†	19.50	to 20.00†
Brass, heavy	12.50	to 13.00†	13.00	to 13.50†
Brass, light	10.75	to 11.00†	10.50	to 11.00†
Lead, heavy	4.87½	to 5.00†	5.00	to 5.25†
Zinc, scrap	12.50	to 13.00†	12.50	to 13.00†

COPPER EXPORTS

Total tons to Jan. 25 18,543

†Nominal.

Corporate and Financial

American Gas & Electric Company, New York, N. Y.—An issue of $1,079,000 of 6 per cent cumulative preferred stock is being sold at par, $50, and accrued dividend. The proceeds from the sale are to be used for extensions and additions to subsidiary companies. The combined statement of earnings for the twelve months ended Nov. 30, 1914, and 1915, follows:

	1914	1915
Gross earnings of all subsidiary companies	$4,305,604	$4,938,478
Balance of subsidiary companies' earnings, after all deductions, applicable to American Gas & Electric Company	$1,004,823	$1,284,724
Other income of American Gas & Electric Company	456,436	457,717
Total gross income applicable to American Gas & Electric Company	$1,461,259	$1,742,441
Total expenses and interest charges of American Gas & Electric Company	679,607	711,456
Balance	$781,652	$1,030,985

American Telephone & Telegraph Company, New York, N. Y.—An issue of $50,000,000 of 4.5 per cent notes of the company has been sold. The opening price of 99.5 soon advanced to par. Part of the notes are direct obligations of the parent company, while others are issued by subsidiaries and guaranteed by the American Telephone & Telegraph Company. The proceeds will take care of the maturity in April and May of $26,325,000 of two-year 5 per cent notes of several of the subsidiaries, leaving upward of $23,000,000 for new construction in the next two years.

Central Maine Power Company, Augusta, Me.—The Maine Public Utilities Commission has authorized the company to acquire the Penobscot Bay Electric Company and the Greenville Light & Power Company. The acquisition of the Greenville company will come through the authorization of the commission to the Penobscot company to take over this property. The financial operations are several. The Central Maine Power Company is authorized to purchase the entire capital stock of the Penobscot Bay Electric Company, the amount of which is 2000 shares, of the par value of $200,000, of which 1317 shares are issued and the balance in the treasury, and in addition all outstanding mortgage bonds of the Penobscot company and of the Belfast Gas & Electric Company. The Central Maine company is to pay $618,000 for these securities, of which amount $538,000 is to be in cash and $80,000 in its 6 per cent cumulative preferred stock. The Central Maine company is to issue its 5 per cent mortgage bonds due Nov. 1, 1939, to the aggregate amount of $433,000, and its 6 per cent cumulative preferred stock to the aggregate amount of $207,000. The terms of the transfer of the Greenville Light & Power Company are contained in a contract between the companies, which are owned, except for $57,000 in underlying bonds, by Albert H. Shaw of Bath and members of the Shaw family. The Penobscot Bay Electric Company is authorized to issue securities in the form of promissory notes to the amount of $243,000, payable in two years from date and bearing interest at 5 per cent, for the purposes of acquiring the Greenville Light & Power Company.

Electric Transmission Companies of Virginia.—An issue of $500,000 of first mortgage 6 per cent, five-year gold bonds, due Dec. 15, 1920, is being offered at 96.86 and interest to yield 6.75 per cent. The proceeds have been used in payment for the property acquired and now owned by the company and for the cost of extensions, additions and betterments heretofore made. The company was recently organized under the laws of Virginia for the purpose of operating public-utility properties and has acquired the properties of the former Electric Transmission Company, the Powell Valley Light & Power Company and the Pennington Light Companies, Inc. The outstanding capitalization consists of $200,000 of 6 per cent preferred stock, cumulative after Jan. 1, 1917; $200,000 of common stock, and the above issue of bonds, which is part of an authorized issue of $1,250,000. The entire stock issue is owned or controlled by the Middle West Utilities Company and affiliated companies. The company operates in southwestern Virginia in the counties of Lee and Wise, which are underlaid with extensive coal beds. In addition to furnishing power to mining companies, which is its principal business, the company also serves the towns of Big Stone Gap, Appalachia, Pennington and St. Charles and has an advantageous power contract with the Kentucky Utilities Company. Under a contract for fifty years, the company has been able to purchase coal for 60 cents per ton at the mouth of the mine, which is at the door of the station. The company has at present in operation about 22 miles of 33,000-volt transmission line. In addition to the generating plant and distributing system, it is the owner of upward of 200 acres of valuable coal lands, which it is estimated is underlaid with 1,000,000 tons of accessible coal.

Great Shoshone & Twin Falls (Idaho) Water Power Company.—The company has been sold under the hammer in Twin Falls for $2,000,000 to the Electric Investment Company, parent of the recent southern Idaho hydroelectric merger. The property was sold under foreclosure proceedings instituted at the instance of the Equitable Trust Company of New York. Since November, 1914, the Great Shoshone has been in the hands of William T. Wallace as receiver, who prior to assuming these duties was general manager of the company. The Great Shoshone company was established by the Kuhns of Pittsburgh and was the pioneer hydroelectric power concern of southern Idaho. It operates in twenty cities and towns, including Twin Falls and Shoshone, with 300 miles of high-tension lines. When the power war broke out in its territory over the advent of the then Beaver River Power Company (later the Idaho Power & Light Company), in the southern part of the State, the Great Shoshone company put up a stubborn fight to hold control. Numerous suits were instituted in the courts over power sites and before the Public Utilities Commission over the exclusive rights to territory occupied. The Kuhns at about this time became financially embarrassed, and the Great Shoshone, with other properties, was placed in the hands of a receiver. The Great Shoshone company gave a ten-million-dollar deed of trust to the Equitable Trust Company. Judge Dietrich of the federal district court wherein the latter company sought to foreclose held that the Equitable Trust Company's claim was not a lien on the personal property of the Great Shoshone company and that the Great Shoshone must be sold separately from the personal property. This latter property consists of supplies, material, tools, bills or accounts receivable, cash on hand, bank balances, stocks of merchandise, ferries, etc. Other creditors of the company have liens on the personal property, and these were held by the court to be prior to those of the Equitable Trust Company.

New England Company, Boston, Mass.—An issue of $1,450,000 of ten-year 6 per cent convertible gold debenture coupon bonds, due Nov. 1, 1925, is being offered at 98 and interest. The bonds are convertible par for par at the option of the holder at any time into first preferred shares of the company, which pay 5.5 per cent dividends until January, 1920, and 6 per cent thereafter. These bonds are issued for permanently retiring various notes of the company which have been issued during the last few years and for financial requirements during the coming year.

Northern New York Utilities, Inc., Watertown, N. Y.—A block of $218,000 of fifty-year first mortgage and refunding 5 per cent bonds, due July 1, 1963, is being offered at 94 and interest.

Pacific Gas & Electric Company, San Francisco, Cal.—A block of $1,900,000 of general and refunding mortgage 5 per cent bonds due Jan. 1, 1942, is being offered at 92.5 and interest.

Union Heat, Light & Power Company, Cincinnati, Ohio.—In connection with the new issue of $5,000,000 5 per cent fifty-year bonds holders of $1,608,000 of outstanding old bonds now maturing have been advised that the new bonds will be exchanged for the old ones at par, besides a payment of a cash difference of 1 per cent on the face value of each bond. Under the mortgage agreement the old bonds became redeemable after May 1, 1906, at 110 and interest, but the company did not exercise its option, and the bonds now fall due May 1, 1918. They are at present quoted on the Cincinnati exchange at 96.25 bid. The new issue will become a first mortgage on the company's properties as soon as the old bonds now outstanding are retired from circulation.

New Utility and Industrial Companies

The Empire District Electric Company of Miami, Okla., has been incorporated with a capital stock of $30,000 by George W. Beck, Jr., and others.

The Francis Gas & Electric Company of Francis, Okla., has been incorporated with a capital stock of $10,000 by James Mascho of Ada, Gus Howerton of Oklahoma City and others.

The Salem Lighting Company of Salem, Ohio, has filed articles of incorporation with a capital stock of $15,000. The incorporators are H. T. Hartman, J. W. Swain, Jr., J. R. Carey, N. B. Swan and E. A. Miller.

The Olive Branch Lighting Company of Noblesville, Ind., has been incorporated by C. D. Zimmer, Marvin Jessup and Adam Kepner. The company is capitalized at $1,000 and intends to generate and distribute electricity.

The National Electric Protective Company of Providence, R. I., has been incorporated by Harold R. Bassett, Max Potter and Claude C. Ball. The company is capitalized at $5,000 and will install burglar and fire alarms and similar apparatus.

The Seneca Power Corporation of Seneca Falls, N. Y., has been incorporated with a capital stock of $5,000 to construct and operate power plants, mills, factories, machinery, etc. The incorporators are H. B. Cutler, P. B. Kendig and H. R. Micks of Seneca Falls.

The E. R. Benson Motor Company of Portland, Me., has been incorporated with a capital stock of $150,000 by E. R. Benson, C. F. Robinson and A. L. Robinson, all of Portland, Me. The company purposes to manufacture and deal in motors and all kinds of electrical devices.

The Requa Electrical Supply Company of Rochester, N. Y., has been incorporated with a capital stock of $25,000 to manufacture electrical apparatus, appliances, etc. The incorporators are W. A. Requa, 478 Arnett Boulevard, and D. R. Cole, 476 Arnett Boulevard, Rochester.

The Schultz Electric Company of New York, N. Y., has been incorporated with a capital stock of $10,000 to do a general contracting, mechanical and electrical engineering work. The incorporators are E. Rothstein, Y. and E. P. Schultz, 22 East Twenty-first Street, New York, N. Y.

The Weehawken Tungsten Lamp Company of Weehawken, N. J., has been incorporated with a capital stock of $10,000 by Helma Puskas, Weehawken, N. J.; Joseph Kelbersberger, Weehawken, and Joseph Force, New York, N. Y. The company intends to manufacture tungsten lamps.

The Barber Electric Manufacturing Company of North Attleboro, Mass., has been chartered with a capital stock of $50,000 by Orin W. Clifford, J. Frank Mason, Charles E. Riley, Harry C. Barber and Louis E. Freeman. The company intends to manufacture and deal in electrical supplies, etc.

The Underground Specialties Company of New York, N. Y., has been incorporated with a capital stock of $100,000 by F. B. Knowlton, A. K. Bliss and E. M. Bayhl, 154 Nassau Street, New York, N. Y. The company proposes to do a general mechanical, electrical and sanitary engineering business, etc.

The Nolen Accessories Company of New York, N. Y., has been incorporated by L. Rommel, F. Spencer Vickery and J. C. Nolen, 452 Fort Washington Avenue, New York. The company is capitalized at $5,000 and purposes to manufacture and deal in talking machines, magnetic reproducers and electrical contrivances.

The European Carbon Corporation of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of dealing in carbon, carbon products, electrical appliances, machinery, equipment, etc. The incorporators are H. Guler, C. Monash and J. Hopkins, 1564 Broadway, New York, N. Y.

The Kansas City Light & Power Company of Kansas City, Mo., has been granted a charter with a capital stock of $2,000, which will be increased later when all formalities of the separation of the lighting company and the street-railway company are complied with. The incorporators of the new company are Frank Hagerman, Clyde Taylor and E. E. Ball.

Trade Publications

Motor-Driven Egg-Boiling Equipment.—An electrically controlled egg boiler is the subject of an illustrated folder prepared by the Hamilton-Low Company, New York.

Desk and Exhaust Fans.—The Eck Dynamo & Motor Company, Belleville, N. J., has prepared a booklet, which is illustrated, on its "Hurricane" desk and exhaust fans.

Alternating-Current Fans.—Bulletin No. 23 issued by the Century Electric Company, St. Louis, Mo., describes and illustrates its various types of alternating-current fans.

Electric Fans.—The General Electric Company, Schenectady, N. Y., has issued an illustrated booklet which describes and illustrates a number of different types of electric fans.

Semi-Indirect-Lighting Fixture.—Engineering data on the "Reflectolyte" semi-indirect-lighting fixture are contained in a bulletin issued by the Frank Adam Electric Company, St. Louis, Mo.

Table and Desk-and-Wall Fan.—The Racine (Wis.) Electric Company has prepared an illustrated leaflet which describes and illustrates its table fan and its combined desk-and-bracket fan.

Electrical Instruments.—The Queen-Gray Company, Philadelphia, Pa., has issued Bulletin E7, on Wheatstone and low-resistance bridges, ohmmeters, resistance boxes and standard resistances.

Electrically Operated Fans.—Catalog No. 15-F describes and illustrates the various types of fans placed on the market by the Menominee Electric Manufacturing Company, Menominee, Mich.

Wiring Devices.—Bulletins Nos. 15-15 and 15-17, prepared by Harvey Hubbell, Inc., Bridgeport, Conn., contain information on and illustrations of side-outlet current taps, side-wire-outlet current taps, and shade holders.

Electric Water Heaters and Urns.—Catalog No. 297 of the Liquid Carbonic Company, Chicago, Ill., containing information on and illustrations of several types of electrically heated water heaters and hot-water urns, has been issued.

Centrifugal Pumps.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., is sending out an illustrated bulletin which gives a summary of a test on a 10-in. centrifugal pump showing a maximum efficiency of 85 per cent.

Color Hoods.—The Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., is sending out a placard illustrated in colors, which it designates as Suggestion No. 14, on color hoods for electric signs and other apparatus for sign illumination.

Electric Railway Light and Power Materials.—Catalog No. 3 prepared by the Drew Electric & Manufacturing Company, Indianapolis, Ind., describes and illustrates a large number of devices for electric railways and light and power companies.

Wood-Preserving Compound.—"Conservation by Preservation" is the subject of an illustrated catalog which contains much information on a compound for treating wood poles, cross-arms, etc., prepared by the C-A-Wood-Preserver Company, St. Louis, Mo.

Electric Pianos.—"Daylight Consumption of Electrical Current" is the title of a placard being sent out by the *Music Trades*, 505 Fifth Avenue, New York, and which is a reprint of an address on electric pianos made by Elmer A. Sperry before the New York Electrical Society.

Ball Bearings.—A very complete, attractively illustrated catalog designated as Catalog No. 105, prepared by the Norma Company of America, 1790 Broadway, New York, contains much information on the use of ball bearings. Included in the catalog are numerous tables and diagrams of applications of "Norma" bearings.

Railway Motors and Switches.—The Westinghouse Electric & Manufacturing Company has recently issued a series of leaflets, designated as No. 3837, No. 3765, No. 3833 and No. 3835, which are descriptive of its railway motors No. 306-V, 307-V, 333-V and 547-A. The company has also prepared Leaflet No. 3551-A, on its Type F alternating-current magnet switches for industrial service, and Leaflet No. 3849, on its Type EA alternating-current low-voltage switches.

New England

TURNER, ME.—The Public Utilities Commission has granted the Turner Lt. & Pwr. Co. permission to issue $25,000 in bonds, the proceeds to be used for the erection of transmission lines within the town of Turner and for improvement to plant and purchase of equipment.

BOSTON, MASS.—The New England Structural Steel Co. is reported to have secured the contract for structural steel for the power station for the Boston Elevated R.R. Co.

TAUNTON, MASS.—The city of Taunton contemplates rebuilding its main power line from the power station to the center of the town; also installing about 2 miles of three-phase, 60-cycle, 2300-volt main-feeder line, using 2-0 wire. Leland D. Wood is manager of municipal plant.

BRIDGEPORT, CONN.—A new turbine generator, additional boilers and other equipment will be installed in the Seaview Avenue power house of the Connecticut Co., doubling the output of the plant.

NORTH GROSVENORDALE, CONN.—The Grosvenor-Dale Co. is contemplating the construction of a power house (60 ft. by 109 ft.) at its plant in North Grosvenordale. Charles M. Praray, New Bedford, Mass., is architect.

NORWICH, CONN.—The commissioners of the municipal electric plant have secured a contract to supply the Hopkins & Allen Corpn. with electrical energy to operate its plant. Motors (700-hp.) and transformers are now being installed. Stephen J. Kehoe is superintendent of the municipal plant.

Middle Atlantic

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Albany, until Feb. 2 for addition to power house, construction and heating work, and addition to boiler plant and equipment at Binghamton State Hospital. Drawings and specifications may be consulted at the Binghamton State Hospital, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Specifications and blank form of proposal may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is State architect.

GOWANDA, N. Y.—Improvements are being made to the plant of the Gowanda Lt. & Pwr. Corpn. (office 1330 Woolworth Building, New York, N. Y.), including repairs to power plant, rebuilding flume, installation of new generator and switchboard panel; new street-lighting system installed and distribution system overhauled; all meters have been changed from 133 to 60 cycles. Extension of transmission line to Perrysburg and Collins is under consideration. H. A. Waldron, Gowanda, is manager.

LOCKPORT, N. Y.—The Council has adopted resolutions directing the corporation counsel and city engineer to prepare plans and specifications in the city's application to be submitted to the State Conservation Commission and State Canal Board for permission to tap the State tunnel in Lockport and to use the surplus waters of the canal for a municipal electric-light plant.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Municipal Building, New York, until Feb. 2 for furnishing three motor-driven service hook and ladder trucks. Bids will also be received on the same date for furnishing ten automobile runabouts. Blank forms and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Municipal Building, New York, until Feb. 9, for furnishing 300 fire-alarm boxes of non-interference, succession type. Bids will also be received at the same place until Feb. 8 for furnishing three motor-driven 75-ft. aerial hook and ladder trucks. Blank forms and further information may be obtained at the office of the Fire Department, eleventh floor, Municipal Building, New York.

NEW YORK, N. Y.—Bids will be received by the Board of Health of the Health Department, corner of Centre and Walker Streets, New York, until Feb. 8 for furnishing and installing lighting fixtures, etc., together with all necessary alterations and other work incidental thereto, for the dormitory for female help on the grounds of the Willard Parker Hospital, at the foot of East Sixteenth Street. Plans may be seen and blank forms for the above work and other information obtained at the office of the chief clerk of the Department of Health.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, tenth floor, Municipal Building, New York, until Feb. 7 for furnishing and installing electric wiring, gas piping and fixture work for the group of buildings in the New York City Home District, Blackwell's Island. Blank forms and further information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, where plans and specifications may be seen. John A. Kingsbury is commissioner.

Construction

News of Projects, Plan, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—Bids will be received by the board of trustees, Bellevue and Allied Hospitals, Staff Room, Bellevue Hospital, 415 East Twenty-sixth Street, New York, until Feb. 7 as follows: (1) For furnishing and installing equipment for the power plant in the Bellevue Hospital; (2) for furnishing and installing equipment for power plants at Gouverneur Hospital, situated at Gouverneur Slip and Front Street; Harlem Hospital, 136th Street and Lenox Avenue, and Fordham Hospital, Crotona Avenue and Southern Boulevard. Blank forms and further information may be obtained at the office of the chief clerk and auditor, 400 East Twenty-ninth Street, New York.

PAINTED POST, N. Y.—Extensions are being made to the power plant at the works of the Ingersoll-Rand Drill Co. in Painted Post.

ROCKWOOD, N. Y.—Plans are being prepared by Morrell Vroom, consulting engineer, Gloversville, for a 1000-hp. hydroelectric power development and storage dam of 100,000,000 cu. ft. capacity for the Rockwood (N. Y.) Mfg. Co. Work will begin as soon as weather permits in the spring.

SENECA FALLS, N. Y.—A company to be known as the Seneca Pwr. Corpn. has been organized by the water-power owners for the purpose of constructing a hydroelectric power plant just below the new dam in Seneca Falls. The officers of the company are: Henry P. Micks, president; Paul B. Kendig, vice-president; Henry B. Cutter, secretary; C. W. Maier, treasurer.

APOLLO, PA.—Application has been made for a charter for the Apollo Electric Steel Co., with a capital stock of $400,000. The company has taken options on a site (eight and one-half acres) and proposes to erect a plant to manufacture steel billets, bars and specialty products. Two electric furnaces will be erected, the daily capacity of each being about 100 net tons. Robert Lock, formerly with the Allegheny Steel Co., will be president and general manager of the Apollo company.

PHILADELPHIA, PA.—Plans are being prepared by Day & Zimmerman, engineers, 611 Chestnut Street, Philadelphia, for the construction of three brick and concrete buildings, including a power house, for the Philadelphia Textile Machinery Co.

PHILADELPHIA, PA.—An ordinance has been introduced in the City Council asking for an appropriation for lighting the city hall from 6 p. m. to 12 p. m. every night in the year. The plans provide for installation of additions to the present plant and additional lamps to flood the William Penn statue, to cost about $9,000. The Mayor has extended the original plans to include the installation of 200 lamps on Broad Street, from Oregon to Albany Avenue, which will increase the cost to about $20,000.

RIDGWAY, PA.—The Ridgway El. Lt. Co. is erecting a new power station, which will be equipped with two 2000-kw., 2200-volt, three-phase, 60-cycle turbo-generator units, three 500-hp. Heine boilers, complete with condensers, transformers, etc. The machinery is now being installed. This station when completed will supply electricity for lamps, heaters and motors in St. Marys, Johnsonburg, Rolfe and Wilcox. Transmission lines have already been erected to these places. J. George Kaelber, Rochester, N. Y., is president of the company.

HOBOKEN, N. J.—Plans have been approved by the Delaware, Lackawanna & Western R.R. Co. for additions to its terminals at Fourteenth Street, Hoboken, calling for an expenditure of $500,000, to include new ferry house, extension of piers, building new boiler, machine and carpenter shops. Electricity will supplant steam as motive power in the new terminal building.

NEW BRUNSWICK, N. J.—Bids will be received by the Commissioners of New Brunswick, 380 George Street, New Brunswick, until Feb. 1, for designing, construction and erection of two steam-turbine reduction-gear centrifugal pumping units having a capacity of 5,000,000 gal. of water per 24 hours each, against a head of 125 ft. and a steam pressure of 165 lb. per square inch at throttle; together with all machinery, tools and appurtenances, in accordance with specifications on file in the office of Asher Atkinson, city engineer, 40 Paterson Street, New Brunswick.

PAULSBORO, N. J.—The public property committee of the Council is negotiating with the officials of the American Ammunition Co. to furnish the borough of Paulsboro with electricity for street lighting. A resolution authorizing an issue of $10,000 in bonds for the installation of a municipal plant will be held up pending the outcome of the negotiations.

PRINCETON, N. J.—The Princeton Lt., Ht. & Pwr. Co. is reported to be contem-

New Ornamental Boulevard Lighting System Completed at Clarinda, Iowa

The contract for the installation of the ornamental lighting system shown in the accompanying illustration was awarded to the Lee Light & Power Company of Clarinda, Iowa, by the city of Clarinda on Oct. 20, 1915, and progress with the work had advanced far enough by Dec. 1 to permit the lamps to be lighted for the first time. The Clarinda boulevard system consists of eighty-one single-lamp "Old Colony" posts, each equipped with a 100-cp. type C Mazda lamp. These standards are placed around the boulevard, which is a double-roadway, paved street, extending two blocks each way from the public square. All lamps are connected in series on a 6.6-amp. circuit, No. 6 safety steel-taped cable being placed underground and running directly to the power house. A ten-year contract for maintaining the lamps was also given to the company at $955.50 per year. This system was installed at the expense of the city, at a cost of approximately $3,000. Ornamental lamps have also been erected around the public square. Rufus E. Lee is general manager of the company.

plating extensions and improvements to its plant, to cost about $23,000.

TRENTON, N. J.—The Ajax Rubber Co., it is reported, is contemplating the construction of a new electric power station in connection with extensions to its factory.

North Central

DETROIT, MICH.—Permission has been granted by the United States government to the Federal Lt. & Pwr. Co. of Detroit to lay cables in the Detroit River for the purpose of transmitting hydroelectric power from Niagara Falls to Detroit. The Federal company is an allied company of the Electric Distributing Co. of Windsor, Ont., which organized six years ago to induce the Ontario Hydro-Electric Commission to extend its transmission line to Windsor with a view of exporting power to Detroit.

FLINT, MICH.—The City Council has granted the Consumers' Pwr. Co. permission to erect eight ornamental lamps on South Saginaw Street for experimental purposes.

HIGHLAND PARK, MICH.—The contract for the installation of the ornamental street-lighting system in Highland Park has been awarded to the Edison El. Illg. Co., Detroit. The plans provide for the erection of 95 ornamental standards mounted with a single 400-cp. lamp, maintained by underground wires. The cost of the installation is estimated at $15,000.

LUDINGTON, MICH.—The Stearns Ltg. & Pwr. Co., Ludington, has submitted a proposal to the City Council offering to replace all of the arc lamps now in use with 400-cp. Mazda lamps at $45 per year, and to reduce the price of the 100-cp. lamps to $20 each per year, provided that the city will give the company a ten-year contract for not less than 38 lamps of 100 cp., not less than 125 lamps of 100 cp., and not less than 20 five-lamp cluster standards, or its equivalent, and also renew the company's franchise for a period of 20 years.

MONROE, MICH.—The general contract for the construction of a new school for St. Mary's College in Monroe, to cost $300,000, has been awarded to John Finn & Son, Detroit. Considerable electric equipment, it is understood, will be required.

AKRON, OHIO.—The Goodyear Tire & Rubber Co., it is reported, is contemplating the construction of a power plant on River Street, to cost about $500,000.

JERRY CITY, OHIO.—The proposal to issue $4,000 in bonds to install a street-lighting system in Jerry City will soon be submitted to the voters.

KENT, OHIO.—Plans are being considered for the installation of a municipal electric-light plant in Kent, to cost about $35,000.

OAKWOOD, OHIO.—The Oakwood Pwr. & Lt. Co. has applied to the State Public Utilities Commission for authority to issue $12,000 in bonds for certain extensions and improvements ordered by the Village Council

URBANA, OHIO.—Plans are being considered by the Urbana Lt. Co. to extend its transmission lines to Mingo, Cable and intermediate points to supply electrical service. An effort will be made to secure installation of electrical equipment in a number of grain elevators in the two towns named.

WILMINGTON, OHIO.—Bids will be received until Feb. 17 by the County Commissioners for the construction of a new court house and jail, including electrical equipment, in accordance with plans and specifications prepared by Weber, Werner & Adkins, architects, Cincinnati, copies of which may be obtained from the county auditor upon deposit of $20. Bids may be submitted on separate branches of the work.

MOUNT STERLING, KY.—The City Council has appointed R. G. Kern and W. B. White to negotiate with the Kentucky Utilities Co., Lexington, regarding the installation of an electric-lighting system in Mount Sterling.

ANDERSON, IND.—Improvements are contemplated to the municipal electric-light plant during the coming year, involving an expenditure of about $100,000.

BLOOMINGTON, IND.—The contract for the electric work for the new men's gymnasium of the Indiana University, to cost $150,000, has been awarded to the Sanborn El. Co., Indianapolis, at $6,650.

JASONVILLE, IND.—The Sullivan (Ind.) County El. Co. has purchased the plant and holdings of the Jasonville Wtr. & Lt. Co., which operates water and lighting systems in Jasonville and furnishes electricity for lamps and motors in Hymera and Coalmont. C. M. Poor is vice-president.

LAFAYETTE, IND.—The General Ser. Co. is installing a 2500-kw. four-stage General Electric Curtiss turbine and condenser in its local plant at a cost of about $35,000. The city of Lafayette has contracted for 62 additional arc lamps, making a total of 462, and for 44 200-watt nitrogen-filled street lamps. Thomas Donohue is local manager.

LEBANON, IND.—The Interstate Pub. Ser. Co. is installing at Lebanon 90 ornamental lamp-posts (Indianapolis Cutter). It is also installing the new General Electric "Nova-Lux" units in the outskirts of the town. Chester P. Wilson, Indianapolis, is president of the company.

MARENGO, IND.—The electric-light and water-works pumping station was recently destroyed by fire. M. R. Churchill is proprietor.

SEYMOUR, IND.—Steps have been taken by local business men to organize a new company to be known as the Commercial El. & Pwr. Co., to install and operate an electric-light plant in Seymour. Application has been made to the City Council for a 25-year franchise to operate in the city. The project has the support of the Commercial Club.

SULLIVAN, IND.—The capital stock of the Sullivan County El. Co. has increased its capital stock from $60,000 to $150,000. The company is contemplating extending its service to many of the larger towns in Sullivan County.

CHICAGO, ILL.—A report submitted to the Commissioners of Lincoln Park Jan. 1, 1916, recommends the installation of one 500-kw., three-phase, 60-cycle, 2300/4000-volt turbo-generator set (non-condensing) taking steam at 150 lb. and exhausting into heating system, and 350 new 400-cp. type "C" boulevard lamps. Extension of heating system is also advised. C. H. Shepard is electrical engineer in charge.

DECATUR, ILL.—The City Council is considering the installation of a new generator in the municipal electric-light plant.

JOLIET, ILL.—Preparations are being made by the Pub. Ser. Co. of Northern Illinois, Joliet, for the construction of a steam-driven generating plant near Brandon's Bridge, southwest of Joliet, to cost about $1,500,000. Sargent & Lundy, consulting engineers, Edison Building, Chicago, Ill., will supervise the construction of the plant.

VIOLA, ILL.—Bids will be received by B. D. Baxter, president board of trustees, Viola, until Feb. 14 for construction of waterworks system, including one 60-000-gal. steel tank on 100-ft. tower (alternate 50,-000-gal. tank), pumping station building complete, piping, valves and connections, one 80-gal.-per-minute deep-well pump, chain-driven from electric motor directly connected to electric motor and a check-valve manhole. Specifications may be obtained from the president of the board or from Terhune & Horton, engineers, Central National Bank Building, Peoria, Ill.

SPARTA, WIS.—Bids will be received by H. B. Sowle, chairman building committee, Monroe County Insane Asylum, care of county clerk, Sparta, until Feb. 10 for construction of addition and alterations to the Monroe County Insane Asylum at Sparta, a power house and also a heating plant and plumbing. Copies of plans and specifications may be obtained on application to Parkinson & Dockendorff, architects, La Crosse, Wis.

WESTBY, WIS.—The electric-light committee contemplates establishing a 24-hour service in the near future. Earl D. Slach is superintendent.

APPLETON, MINN.—Bids will be received by the board of education, school district No. 9, of Swift County, at the office of O. B. Carlson, clerk of board, Appleton, until Feb. 14 for construction of new two-story-and-basement high-school building and for additions to and alterations in the present high-school building in Appleton, separate bids to be submitted as follows: (a) General contract work and all material, except brick, sand and gravel; (b) heating; (c) plumbing; (d) electrical wiring. Plans and specifications may be obtained on application to Edwins & Edwins, architects, Northwestern Building, Minneapolis, upon deposit of $15 for (a) plans and $9 for each set of (b), (c) and (d) plans, two-thirds to be refunded upon return of plans.

BRANDON, MINN.—The installation of an electric-light plant in Brandon is under consideration. Alfred J. Christensen is interested in the project.

CYRUS, MINN.—A franchise has been granted to R. C. Gust, Cyrus, for the installation of an electric-lighting system here.

ST. CLOUD, MINN.—The St. Cloud Pub. Ser. Co. is contemplating extensive additions to its hydroelectric power plant, which may mean the construction of an additional power house on the Mississippi River, which will probably increase the generating capacity by 4000 kw. A. J. Bemis is general manager.

ST. PAUL, MINN.—Plans are being considered by the St. Paul Lt. & Pwr. Co. for the construction of a large hydro-electric plant.

ALBION, IOWA.—At an election to be held Feb. 1 the proposal to grant the Iowa Ry. & Lt. Co., Cedar Rapids, a 25-year franchise to supply electricity in Albion will be submitted to the voters.

BELMOND, IOWA.—Bids will be received by C. O. Fitts, secretary of the school district of Belmond, until Feb. 23, for the erection of a high and grade school building, according to plans prepared by G. L. Lockhart, architect, Endicott Building, St. Paul, Minn. Separate bids to be submitted as follows: General construction, heating and ventilating, plumbing, electrical work, science and laboratory equipment, gymnasium equipment, and seating. Plans will be on file on and after Feb. 8 at the office of the architects, St. Paul, Minn.; at the office of C. O. Fitts, secretary, Belmond, and at the Builders' Exchanges at Des Moines, Iowa; Omaha, Neb., and St. Paul and Minneapolis, Minn.

CLARINDA, IOWA.—The Lee Light & Power Co., Clarinda, is now erecting a new power house and office building. Rufus E. Lee is general manager.

NEW HAMPTON, IOWA.—The County Commissioners have granted F. A. Schuet, A. D. McKinely and W. W. Murray a franchise to erect and operate electric transmission lines on the public highways in Chickasaw County.

OELWEIN, IOWA.—The Fayette County Utilities Co., Oelwein, is reported to be contemplating extending its electric transmission from Oelwein to Hazleton to supply electrical service in that town.

VINTON, IOWA.—Plans are being considered by the Iowa Ry & Lt. Co., Cedar Rapids, to extend its transmission lines from Vinton to Shellsburg, Benton County, and to Reinbeck, Grundy County.

AURORA, MO.—The Lawrence County Wtr., Lt. & Cold Storage Co., Aurora, is now erecting a 6600-volt, three-phase, 25-cycle transmission line to the substation of the Ozark Pwr. & Wtr. Co., 1½ miles from its station. Will make connection with the lines of the Ozark company within the next 30 days. J. R. Woodfill, Jr., is president and manager.

CUMBERLAND, MO.—The proposal to issue $25,000 in bonds for remodeling the municipal electric-light plant will be submitted to the voters.

DEARBORN, MO.—A franchise has been granted to F. E. Jeffers to supply electricity in Dearborn. Energy to operate the system will be secured from the McComas dam on Platte River.

JOPLIN, MO.—A new steam turbo-generator set having a rating of 10,000 hp., with necessary transformers and auxiliary machinery, will be installed at the Riverton (Kan.) plant of the Empire District El. Co. An addition will also be built to the power house. The cost of these improvements is estimated at $20,000. George Hayler is general superintendent of the company.

KANSAS CITY, MO.—Bonds to the amount of $50,000 have been sold, the proceeds to be used for extension to the electric-lighting system.

MONETT, MO.—The Ozark Pwr. & Wtr. Co., Branson, is contemplating the construction of a substation in Monett, to cost about $40,000.

MOUNT VERNON, MO.—Improvements are contemplated to the municipal electric-light plant, involving an expenditure of about $10,000.

SPRINGFIELD, MO.—At an election held Jan. 11 the proposal to issue $400,000 in bonds for the installation of a municipal electric-light plant was defeated.

BOWMAN, N. D.—The Bowman El. Lt. & Pwr Co. has purchased complete new equipment for its plant, which will be installed in the spring. When completed a day service will be established. The company is also planning to establish a steam-heating service next winter. W. R. McKenzie is president.

LAKE NORDEN, S. D.—The Council is considering the question of calling an election in the spring to submit the proposal to issue bonds for the installation of an electric-lighting system in Lake Norden.

SPRINGFIELD, S. D.—The Artesian Lt. Co. is planning the installation of a larger plant in the spring. J. L. Turner is president.

WINNER, S. D.—Work will begin before April 1 on the installation of the electric-lighting system by Floyd D. Hunt, Chicago, Ill., who was recently granted a 20-year franchise in Winner.

HOLDREDGE, NEB.—The Intermountain Ry., Lt. & Pwr. Co., which recently took over the property of the Holdredge Ltg. Co., has just completed the installation of a 180-kva. Allis-Chalmers generator and a 100-hp. Diesel oil engine. The erection of a 20,000-gal. steel elevated tank is nearing completion, and transmision lines are being erected to Funk, Wilcox and Hildreth to supply electrical service in those towns.

VARPARAISO, NEB.—The plant of the Valparaiso El. Co. was destroyed by fire recently. Arrangements, it is said, are being made to rebuild the plant at once.

BUCKLIN, KAN.—The village of Bucklin has decided to abandon its municipal electric-light plant and to purchase electricity from the Midland Wtr., Lt. & Ice Co., Dodge City. Arrangements are being made by the Midland company to extend its transmission lines to Bucklin, and its service will include the town of Ford. The cost of the extension is estimated at $20,000. Otto Thies is general manager of the Midland company.

CEDAR, KAN.—The local electric-light plant was recently destroyed by fire. The plant, it is understood, will be rebuilt in the near future.

McPHERSON, KAN. — Improvements contemplated to the municipal electric-light plant and water-works system this year will consist of an electric generating unit, a voltage regulator and probably a reservoir for water-works. Arthur Groesbeck is manager.

OAKLEY, KAN.—Contracts have been awarded by the Municipal Water and Light Department for the installation of a new electric generating unit, consisting of a 70-hp. De La Vergne crude-oil engine, a 62½-kva., three-phase, 60-cycle, 2300-volt generator, and one 20-hp. motor. W. B. Day is superintendent.

Southern States

LENOIR, N. C.—The Citizens' Lt. & Pwr. Co., Lenoir, has closed a contract with the Ivey Pwr. Co. for hydroelectric power for a period of 10 years. The Ivey Pwr. Co., Lenoir, will construct a plant on Gunpowder Creek, near Granite Falls, and would like to receive catalogs, etc., from manufacturers of electrical machinery, equipment, etc. E. C. Ivey, Lenoir, is manager of the Ivey company.

MADISON, GA.—The managers of the municipal electric-light plant expect to purchase a voltage regulator. G. W. Hubbard is superintendent.

PEARSON, GA.—A franchise has been granted to the Pearson Mfg. Co. for the installation of an electric-light plant and water-works system.

KINGSPORT, TENN.—The Federal Dyestuff & Chemical Co., 30 Pine Street, New York, N. Y., is reported to have engaged the Southwestern Engineering Co., Bristol, Va., to design and build a steam-driven electric generating plant for its chemical factory, to cost about $100,000.

KINGSPORT, TENN.—Plans are being considered by the Clinchfield Portland Cement Corpn., Kingsport, to increase the output of its power plant to supply electricity to industrial plants in this vicinity. It is proposed to build a new station of from 7000 kw. to 10,000 kw. rating. L. L. Griffiths, Kingsport, is general superintendent.

FAIRHOPE, ALA.—At an election held recently the proposal to issue $5,000 in bonds for the installation of a municipal electric-light plant was carried. Xavier A. Kramer, Magnolia, Miss., is engineer.

MOBILE, ALA.—The City Commissioners are reported to be considering having all wires placed underground in the city.

PASS CHRISTIAN, MISS.—The proposal to issue $7,000 in bonds for the installation of an ornamental street-lighting system will be submitted to the voters on Jan. 31. Xavier A. Kramer, Magnolia, Miss., is engineer.

ASHDOWN, ARK.—The Ashdown Lt. & Pwr. Co. will install two Morse-Fairbanks oil engines (one 25-hp. and one 75-hp) in about 60 days. L. M. Warmack is owner.

HEBER SPRINGS, ARK.—The Heber Springs Lt. Co. is negotiating for a contract for supplying electricity for operating the pumping station of the municipally owned water-works system. If the deal goes through, the company will change its system to three-phase, 60 cycles, and will install two directly connected generating units, one of 120 kw. and one of 60 kw., driven preferably by Corliss engines; one 125-hp. boiler and one pump, complete with switchboards, exciters, etc. The company expects to exchange its present equipment for the above. H. N. Case is manager.

MARIANNA, ARK.—The Arkansas Lt. & Pwr. Co., Arkadelphia, expects to install a new engine and generator in its local plant.

NEWPORT, ARK.—The Arkansas Lt. & Pwr. Co., Arkadelphia, expects to erect a new power plant in Newport and install new equipment, including engines, generator and switchboard.

MOUNTAIN VIEW, OKLA.—Bonds to the amount of $8,000 have been voted for the municipal electric-light plant.

STRATFORD, OKLA.—The proposal to issue $10,000 in bonds for the installation of a municipal electric-lighting plant will soon be submitted to the voters.

AUSTIN, TEX.—Plans are being considered by the Texas Pwr. Co., Dallas, it is reported, for the erection of a large power plant in Austin. The company is also planning to extend its electric transmission lines to points south of Waco and Austin.

GALVESTON, TEX.—Bids will be received by John D. Kelly, city secretary, Galveston, until Feb. 10 for sinking three 12-in. wells for the city water supply at Alta Loma and for equipment, and also the necessary pumping apparatus, having a daily capacity of 3,000,000 gal., to be electrically operated. Specifications may be seen at the office of the city secretary, from whom copies may be obtained upon application.

GALVESTON, TEX.—The committee of engineers appointed by the Mayor to report on water-works system at Alta Loma as to the advisability of installing an air compressor recommends that bids be asked for drilling four wells, each producing 1,000,000 gal. daily; also that a steam-driven generating unit of high efficiency be installed. The cost of wells, pumps and motors is estimated at $28,000, and that of pipes, electrical equipment and other necessary equipment at $15,000 additional.

NIXON, TEX.—Application has been made to the City Council for a franchise to install and operate an electric-light plant in Nixon.

TYLER, TEX.—The property of the Tyler Trac. Co., it is reported, has been purchased by F. C. Cotton of Denver, Col. The new owner, it is understood, will install new machinery in the power plant and make extensions to the lines.

Pacific States

COUPEVILLE, WASH.—The local electric-light plant has been purchased by H. E. Wood, Langley, who, it is said, intends to make extensions and improvements to the system. Mr. Wood will take over the management of the property Feb. 1.

EPHRATA, WASH.—Application has been made to the City Council by the Grant County Pwr. Co., Wilson Creek, for permission to erect an electric-light and power system in Ephrata.

NORTHPORT, WASH.—The Northport Smelting & Refining Co. is reported to have purchased a power site at the source of the smelter's flume, several miles out of Northport. The site includes what is known as the old Morrill mill site.

PE ELL, WASH.—The electric plant of the Central Lt. & Mfg. Co., Pe Ell, has been put out of commission by the washing out of its dam across the Chehalis River. The dam cannot be repaired until the dry season sets in next summer. The company, it is reported, is considering the installation of an engine to drive the plant in the meantime.

FORT TOWNSEND, WASH.—The City Council has instructed the city attorney to prepare an ordinance to submit to the voters the proposal to purchase the electric plant of the Key City Lt. & Pwr. Co., to be owned and operated by the municipality. The company has offered to sell the plant for $75,000.

SPOKANE, WASH.—Property owners on Sprague Avenue have petitioned the City Council for a curb-lighting system on that thoroughfare.

BURNS, ORE.—The El. Lt. & Pwr. Co. of Burns expects to purchase a Diesel or similar engine of about 100 hp. within the next 12 months. H. M. Horton is president.

CONDON, ORE.—The Condon El. Co. is negotiating with the city for contract for pumping the city water supply. If the deal goes through, the company expects to install a 100-kw., three-phase, 2300-volt generator. A. B. Bowers is manager.

OSWEGO, ORE.—The Commissioners of Multnomah County have granted the Oswego Lake Wtr., Lt. & Pwr. Co. a 25-year franchise to erect and operate electric transmission lines over the county roads.

PRAIRIE CITY, ORE.—Permits have been granted by the State engineer to the Prairie Pwr. Co. for the development of 952 hp. from John Day River and Warm Springs, near Prairie City. The company proposes to extend canal near Prairie City about 2 miles, construct a reservoir at Strawberry Lake and develop power to generate electricity to be transmitted to Prairie City, Canyon City and John Day. The cost of the work is estimated at $45,000.

SALEM, ORE.—Mayor H. O. White has recommended the installation of a municipal electric-lighting plant to the City Council.

RIVERSIDE, CAL.—The Council has approved the recommendation of an extension of the lighting system along Palmyrita Avenue.

SAN FRANCISCO, CAL.—The City El. Co. has purchased a site on Bush Street west of Grant Avenue, on which it proposes to erect a substation two or three stories high.

SAN FRANCISCO, CAL.—Plans are being considered by the Downtown Association and the lighting committee of the supervisors for the installation of luminous-arc lamps on Market Street, from the Embarcardero to Fulton Street, to cost about $35,000 per year. The Pacific Gas & El. Co. will bear the cost of installing the new lamps, which is estimated at $100,000.

VICTORVILLE, CAL.—The Southern Sierra Pwr. Co., Victorville, has secured a contract to furnish energy to the Southwestern Portland Cement Co., Victorville, with 1400-kw. load, using three 500-kva., 33,000/1440-volt transformers. The company will erect 10 miles of three-phase, 33,000-volt transmission line from substation to cement plant. B. T. Ergenbright is local superintendent.

HAILEY, IDAHO.—The City Council has granted R. W. Ferris a second franchise to install and operate an electric light and power plant and distribution system in Hailey. Under the terms of the franchise work must be started before May 1, 1916.

KINGMAN, ARIZ.—The Desert Pwr. & Wtr. Co., Kingman, is extending its transmission lines to Chloride and Oldtrails. F. A. Wilde, Jr., is treasurer and manager.

PHOENIX, ARIZ.—The City Council has engaged Burns & McDonnell, consulting engineers, Interstate Building, Kansas City, Mo., to prepare preliminary plans and estimates and report on the installation of a complete municipal electric-light plant and a new municipal gas plant for the city of Phoenix. After completion of preliminary plans a bond election will be called. The cost of these improvements is estimated at $750,000. In connection with these improvements the city has under consideration the purchase of energy from the Roosevelt dam. George W. Barrows is chairman of committee.

BOZEMAN, MONT.—The City Council has recommended the installation of a special lighting system to include the whole city of Bozeman, supplementing the cluster lamps recently installed on Main Street. The new plans provide for ornamental steel posts placed along the curb, to cost approximately $85,428.

TRINIDAD, COL.—A number of improvements are contemplated by the Trinidad El. Trans. Ry. & Gas. Co., including the installation of a new turbine, depending on closing certain power contracts. The company expects to conduct a vigorous campaign for house-wiring and for the sale of heating appliances. F. P. Wood is general manager.

Canada

COBDEN, ONT.—The city of Cobden is contemplating the installation of a distributing system for hydroelectric power, to cost about $20,000.

MONTREAL, QUE. — The Montreal Tramways Co. is contemplating extensions and improvements to its steam generating plant on Notre Dame Street, to cost between $2,000,000 and $3,000,000.

YORKTON, SASK.—The Yorkton Municipal Power and Light Department expects to install a 500-hp. boiler unit about next October, for which contracts have been placed. W. D. Macpherson is general superintendent.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 10 for furnishing masthead lamps, generator brushes, lead bends, steel clamps, vises, drills, etc. Blanks and general information relating to this circular (No. 1098) may be obtained at the above office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,168,270. PROTECTION DEVICE FOR ELECTRIC CIRCUITS; H. DeF. Arnold, East Orange, N. J. App. filed Dec. 14, 1914. Two unilaterally conducting elements in series.

1,168,280. METHOD AND APPARATUS FOR ELECTROPLATING PIPES AND OTHER ARTICLES OF MAGNETIC MATERIAL; N. W. Buch, New Castle, Pa. App. filed June 23, 1913. Includes a magnetic lifting frame.

1,168,281. ELECTROPLATING APPARATUS; N. W. Buch, New Castle, Pa. App. filed June 23, 1913. Magnetized cathode member.

1,168,284. SANITARY COVER FOR TELEPHONE MOUTHPIECES; E. E. Claussen, Hartford, Conn. App. filed Oct. 27, 1914. Constructed of paper with flange to grip mouthpiece.

1,168,312. LOADING COIL AND CASE THEREFOR; S. B. Kent, New York, N. Y. App. filed Sept. 12, 1914. Air-gap construction coil of minimum size.

1,168,314. IGNITION SYSTEM; C. F. Kettering, Dayton, Ohio. App. filed Nov. 3, 1910. Dissipates conductive currents in the secondary circuits.

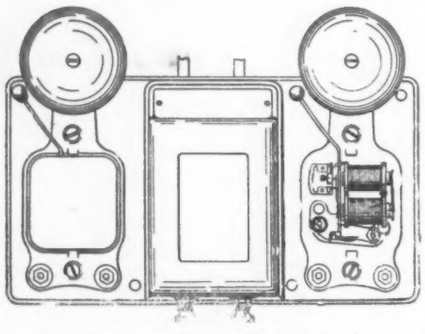
1,168,319. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Aug. 22, 1913. Operator's set automatically associated with selected connecting circuit.

1,168,322. AUTOMOBILE HORN; R. H. Manson, Elyria, Ohio. App. filed April 24, 1911. Contacts arranged to prevent accidental operation.

1,168,346. APPARATUS FOR ELECTRIC WELDING; E. Thomson, Swampscott, Mass. App. filed Feb. 20, 1915. "Snap" weld.

1,168,351. BATTERY LAMP; F. W. Wakefield, Vermilion, Ohio. App. filed Feb. 20, 1915. Lantern construction using ordinary dry cell.

1,168,371. CIRCUIT CONTROLLER; W. P. Anderson, Dayton, Ohio. App filed Sept. 12, 1912. Compensates for inaccuracies in the switch elements.



1,168,378—Transformer-Bell Device

1,168,378. TRANSFORMER-BELL DEVICE; C. E. Campbell, Lynn, Mass. App. filed Sept. 2, 1915. Bells and transformer mounted on common base.

1,168,383. METHOD OF STARTING SYNCHRONOUS POLYPHASE MOTORS; C. J. Fechheimer, Glen Ridge, N. J. App. filed May 6, 1913. Applies to motor armature voltages which are fractions of the working voltages.

1,168,385. ATTACHMENT FOR ELECTRIC WELDING MACHINES; E. Fulda, New York, N. Y. App. filed Aug. 6, 1913. Includes an auxiliary hinged electrode arm.

1,168,411. ELECTRIC FILAMENT LAMP; T. O'Donnell, Ironwood, Mich. App. filed Nov. 6, 1914. Separate filaments of two or more lamps are combined in a single lamp.

1,168,419. SELECTOR SWITCH; J. N. Reynolds. Greenwich, Conn. App. filed Dec. 16, 1913. Improved terminal bank structure.

1,168,432. TELEGRAPHONE; F. Seelau, Berlin-Wilmersdorf, Germany. App. filed May 28, 1914. Set into operation to record incoming calls.

1,168,438. ELECTRIC RELAY; R. W. Tarrant, Clapham, London, England. App. filed June 3, 1914. Embodies field electromagnet and armature electrode magnet.

1,168,439. SYSTEM OF CONSTANT-CURRENT DISTRIBUTION; P. H. Thomas. Upper Montclair, N. J. App. filed March 22, 1913. Overcomes tendencies to disturb series operation.

1,168,506. PNEUMATIC ELECTRIC FIRE ALARM; C. J. Jenne, San Francisco, Cal.

Record of Electrical Patents

Notes on United States Patents issued Jan. 18, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

App. filed Dec. 28, 1914. Tube system with pressure cylinder and gage.

1,168,519. ELECTROMAGNETIC FREQUENCY METER AND THE LIKE; K. R. Liljeblad, Jartva, near Stockholm, Sweden. App. filed Dec. 1, 1913. Juxtaposed coils with cores on single shaft.

1,168,529. CONNECTOR FOR ELECTRIC CONDUCTORS; H. F. Maxim, Norfolk, Va. App. filed Jan. 15, 1913. Spring clip for dry cell.

1,168,538. ELECTRICITY RECTIFIER; T. J. Murphy, Rochester, N. Y. App. filed March 15, 1910. Synchronous light-running motor.

1,168,541. APPARATUS FOR WIRELESS TELEPHONY; E. B. Myers, New York, N. Y. App. filed Dec. 27, 1911. Selectively and secretly tuned.

1,168,571. ELK'S CLOCK; T. W. Shepherd, Waltham, Mass. App. filed Dec. 10, 1913. Elk's head attachment for clock dial.

1,168,587. MEANS FOR INDICATING FAULTS AND BREAKS IN ELECTRIC CONDUCTORS; E. Baillat, Pont de Beauvoisin, France. App. filed May 4, 1914. Independently acting indicating and circuit-breaking devices.

1,168,595. LIGHTNING ARRESTER; A. J. Bowie, Jr., San Francisco, Cal. App. filed Feb. 26, 1910. Discharges without materially affecting line voltage.

1,168,596. CABLE-BONDING DEVICE; E. L. Brockway, Glenside, Pa. App. filed Jan. 16, 1915. Readily applied to adjoining cables.

1,168,603. PRINTING TELEGRAPH; L. Cerebotani, Munich, Germany. App. filed April 24, 1913. Type wheel continues to rotate after an impression.

1,168,624. TROLLEY RETRIEVER; R. E. Gearhart, Maryville, Mo. App. filed May 8, 1915. Particularly simple construction.

1,168,630. SIGNAL SYSTEM; B. B. Hatch, Boston, Mass. App. filed July 16, 1915. Two normally closed disarrangement circuits.

1,168,637. SELF-RESTORING SWITCH FOR IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES; F. R. Hoyt, East Orange, N. J. App. filed Jan. 29, 1915. Thermostat breaks circuit when contacts stop in closed position.

1,168,638. PERIODIC INTERRUPTER FOR IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES; F. R. Hoyt, East Orange, N. J. App. filed Jan. 29, 1915. Two breaker arms simultaneously moved in opposite direction.

1,168,639. BATTERY ALTERNATOR FOR IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES; F. R. Hoyt, East Orange, N. J. App. filed Feb. 2, 1915. Battery current reversed at each separation of the contacts.

1,168,696. TELEGRAPHIC TRANSMITTING DEVICE; J. H. Abernethy, Danville, Va. App. filed April 17, 1915. Series of dots produced by single operation.

1,168,699. WATER-LEVEL-ACTUATED MECHANISM; A. Arbib, New York, N. Y. App. filed Nov. 12, 1913. Rings alarm when bathtub is filled.

1,168,704. TYPE-OPERATING MECHANISM FOR TYPEWRITING MACHINES; O. Bennett, Placerville, Cal. App. filed Jan. 18, 1915. Electrically operated type.

1,168,706. TENSION INDICATOR FOR FELTS, FOURDRINIER WIRES AND PAPER SHEETS; J. W. Brassington, Wilmington, Del. App filed June 9, 1915. Indicates tension condition of Fourdrinier wire to spuerintendent.

1,168,724. ELECTRIC LANTERN; W. P. Hartford and C. M. Rickoff, Chicago, Ill. App. filed Aug. 7, 1915. Dry cell in base of lantern structure.

1,168,753. RAIL BOND; B. F. Silliman, Cleveland, Ohio. App. filed May 17, 1913. Applied to rail by pencil arc welding.

1,168,755. ELECTRICALLY OPERATED MUSICAL INSTRUMENT; I. B. Smith, Philadelphia, Pa. App. filed May 26, 1910. Automatic player, particularly for grand piano-players.

1,168,761. ELECTRIC ALARM MECHANISM; E. A. Traux, Inglewood, Cal. App. filed May 16, 1914. Clock-control signal.

1,168,774. METERING PANELBOARD; F. B. Adam, St. Louis, Mo. App. filed April 1, 1911. Particular meter busbars can be easily selected and connected.

1,168,796. WIRE HOLDER AND INSULATOR; C. S. French, Salem, Ohio. App. filed Sept. 5, 1912. Obviates necessity for wrapping wire around insulator.

1,168,826. ELECTRIC LANTERN; J. G. Peterson, Jersey City, N. J. App. filed May 28, 1915. Lantern case receives standard dry cell.

1,168,837. METHOD OF PRODUCING ELECTRICAL OSCILLATIONS; E. von Lepel, Berlin-Wilmersdorf, Germany. App. filed Dec. 29, 1914. Extinguishes spark after first half oscillation.

1,168,846. ELECTRICAL BELL ATTACHMENT FOR PIANOS; R. A. Bessinger, Wellington, Ohio. App. filed July 16, 1915. Electric bell-ringing device attachable to any piano.

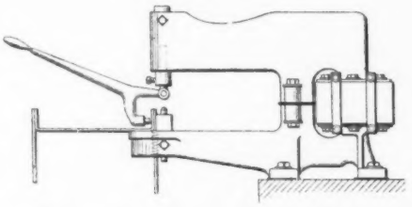
1,168,892. BATTERY LAMP; N. Kribs, Dundee, Ill. App. filed May 10, 1915. Uses ordinary dry cell; pivoted lamp holder.

1,168,894. TELEPHONE-EXCHANGE TRUNKING SYSTEM; F. Lubberger, Chicago, Ill. App. filed Nov. 29, 1909. Semi-automatic (seventy-three claims).

1,168,904. EXTENSION OR PARTY-LINE TELEPHONE; R. Owens, Chicago, Ill. App. filed July 5, 1906. Automatic or semi-automatic.

1,168,957. INDICATING APPARATUS; N. J. Nessa, Sioux Falls, S. D. App. filed Sept. 9, 1914. Float-operated circuit closer.

1,168,971. MAIL-BOX SIGNAL; A. Sinicki, Pittsburgh, Pa. App. filed Feb. 27, 1915. Flag on mail box indicates where push-button in house is pressed.



1,168,385—Attachment for Electric Welding Machines

1,168,977. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed March 28, 1913. Quick make-and-break key socket.

1,169,005. COMBINED LEVEL AND PLUMB; G. W. Caswell and C. E. Welt, Cliftondale, Mass. App. filed Sept. 15, 1915. Dry cell and bulbs contained in level stock.

1,169,011. INSULATOR; H. A. Cook, Dixon, Neb. App. filed Sept. 26, 1914. Made of reinforced glass.

1,169,038. TELEPHONE RECEIVER; A. D. Jones, Philadelphia, Pa. App. filed May 7, 1913. Novel mounting of diaphragm and armature.

1,169,067. METHOD AND MEANS FOR AUTOMATIC ACCOUNTING; W. J. Crumpton, Superior, Wis. App. filed Aug. 4, 1908. Timer, counting wages, etc. (126 claims).

1,169,078. ACCOUNTING SYSTEM; F. O. Heuser, Chicago, Ill. App. filed Jan. 3, 1910. Wage accounting and distribution to a plurality of jobs.

1,169,082. DISCHARGE TUBE; R. von Lieben, E. Reisz and S. Strauss, Vienna, Austria-Hungary. App. filed June 29, 1912. Incandescent metallic oxide cathodes.

1,169,089. ELECTRIC SWITCH; B. L. Lawton and B. A. Spitzer, Meriden, Conn. App. filed July 6, 1915. For automobile lights particularly.

1,169,099. SNAP SWITCH; E. C. Wilcox and B. A. Spitzer, Meriden, Conn. App. filed June 22, 1914. For automobile lighting systems.

1,169,102. MEASURED-SERVICE TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed Jan. 17, 1907. Common battery, automatic or semi-automatic.